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The views and recommendations expressed in this report are those of the author and not necessarily those of the department.

WAINWRIGHT STUDY AREA

A Biophysical Inventory

by

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ABSTRACT

This report was prepared to document field studies conducted for the Natural Areas Program.

The Wainwright study area was chosen for field investigation because it is one of the few remaining blocks of native Aspen Parkland.

Background information was required for decisions concerning management and possible future nomination as an ecological reserve to represent the central section of the Parkland Region in Alberta.

The study area encompasses 4 468 hectares (ha) of aspen groveland interspersed with grassland, aeolian landforms and vegetation, interdune fen complexes, a variety of wetland types, and kame and disintegration moraine. It is provincial Crown land administered by the Public Lands Division of the Alberta Department of Energy and Natural Resources. The Buffalo Park Grazing Association holds a grazing lease on most of the area.

During the spring and summer of 1983, field work and literature surveys were conducted to describe the vegetation, compile flora and fauna species lists, assess disturbances and describe the physical environment. Discussions on bedrock and surficial geology, drainage, climate and history are based on literature.

Based upon literature reviews and field research, the vascular flora consists of 406 species distributed among 62 families and 205 genera. Three species are considered rare in Alberta. The non-vascular flora consists of 81 species of which 31 are lichens and 50 are mosses.

The study area supports a diversity of vegetation. About one-third of it is grassland. Important grassland species include blue grama, sand grass, rough fescue, porcupine grass and sage species. Buckbrush communities and wolf willow-buckbrush communities are scattered throughout the grassland. Aspen groves situated in mesic locations have well-developed shrub layers and a lush herb-dwarf shrub layer. In contrast, aspen groves growing under xeric conditions have a shorter tree canopy and the shrub and herb-dwarf shrub layers are composed of xerophyllic species.

Blowouts and interdune depressions are vegetated with xerophyllic lichens, grasses and forbs. Willow communities occupy the banks of wetlands and damp depressions. Balsam poplar stands usually ring willow stands. Sloughs, lakes and ponds are ringed with hydrophyllic herbs and grasses such as sedges, bulrush and manna grass. Wet meadows support mint, blue grasses, Baltic rush and silver weed. Fens are dominated by dwarf birch, willows, sedges and mosses such as Drepanocladus spp. and Tomenthypnum nitens.

Based on earlier land surveys and aerial photograph interpretation there has been a 23% increase in area of poplar forest between 1903 - 1904 and 1979. This is concurrent with a 13% decrease in grassland and a seven % decrease in scrubland (stunted aspen and grassland).

The study area is important for wildlife due to its diversity of habitats and its location next to the Canadian Forces Base Wainwright and the Ribstone Creek valley. The habitat value to wildlife will increase as habitat destruction in the Parkland continues. A total of 122 bird, 31 mammal and five reptile and amphibian species have been recorded in the study area.

Most disturbances in the area are because of ranching operations and oil and gas industry activities. Seismic cutlines and roads were built by the oil and gas industry, but all are growing in except for those used as access roads by ranchers. The most recent disturbances are associated with the institution of a range management plan and include the construction of dugouts, cutlines, new fences and cross fences, brushing of poplar forest and experimental cultivation and seeding of domestic grasses. Vegetation could be damaged severely if vehicular use increases in the dune area.

Nine special features are identified; the Ribstone Creek valley, Wallaby and David Lakes, beaver ponds, a spring, the dune-fen complex, the sloping fen, the extensive and diverse flora and the occurrence of tiger salamanders.

The Wainwright study area and the candidate Rumsey Ecological Reserve, also a block of native Parkland, were compared. Wainwright is the more heterogeneous area, but it is also in a more disturbed state. Relatively-pristine fescue grasslands occupy three-quarters of the Rumsey area; aspen and balsam poplar forest account for almost half of the Wainwright area.

Management recommendations for the Wainwright area are discussed briefly in the report.

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1. INTRODUCTION

In the summer of 1983 a study of the Wainwright area was undertaken to collect and integrate information that could be used in making decisions regarding the suitability, site selection and management of an ecological reserve in the Wainwright Sandhills.

The Wainwright area was chosen by the Natural Areas Program as a representative of the central section of the Parkland Region in Alberta. It encompasses 4 468 ha (17 1/4 mi.^{2}) and includes a variety of diverse habitats, including aspen (*Populus tremuloides*) groveland interspersed with grassland, aeolian landforms and associated vegetation, interdune fen complexes, a variety of wetland types, and kame and disintegration moraine.

This area is complementary to the candidate Rumsey Ecological Reserve. Rumsey is an area of 3 445 ha (13 1/4 mi.^{2}) and contains good representation of aspen groveland, fescue (*Festuca scabrella*) grasslands and hummocky moraine.

Except for small extensions into the United States, the Aspen Parkland is a major vegetation zone unique to Canada. In Canada it extends in a band 80 to 240 km wide from the U.S. border in northwest Manitoba to the Edmonton region, where it turns south and continues down along the foothills in a 40 km wide band back to the international boundary.

The Aspen Parkland is a transition zone between the deciduous forest to the east, the Boreal forest to the north, the Cordilleran forest to the west and the grasslands to the south. It is a mosaic of aspen groves and prairie grassland, and the climate is unique to the area.

In Alberta the Parkland is the second largest ecoregion and occupies 11.1% (or 73 500 km) of the province (Strong and Leggat 1981). The region has been modified greatly since settlement. About 90 to 95% of Canada's Parkland has been altered or destroyed by clearing and cultivation (North 1976). This study is part of an effort to preserve examples of Aspen Parkland in its natural state.

The objectives of the study were:

1. Identify and describe the plant community types,
2. Compile flora and fauna species lists,
3. Identify and describe manmade disturbances,
4. Describe the physical environment,

5. Conduct a literature search for studies previously conducted in the area,
6. Compare and contrast the Wainwright study area and the candidate Rumsey Ecological Reserve.

1.1 Present Administrative Status and Disposition

Land within the study area is provincial Crown land in the white area. The study area is under a reservation (RXR 4) by a variety of agencies. All dispositions are allowed, except those leading to title, provided they are consistent with the policy of the specified agencies.

A map showing land dispositions within the study area is presented in Appendix 1.

Mineral rights in the study area are owned by the Crown. Mineral surface leases have been granted on S and NW 11, SE 15, NE 2 and NE 10 -42-5-W4. Capped gas wells are located in each of NW 1 and SE 15 -42-5-W4. Two abandoned gas wells are located in SW 9 and SE 18 -42-5-W4 and one in NW 33-41-5-W4 (Appendix 1).

All but one quarter section of the study area is contained in grazing lease 38839. This lease is held by the Buffalo Park Grazing Association (BPGA). The northeast quarter of section 7-42-5-W4 is under grazing lease 33916.

Within the study area the BPGA is divided into range 4 (BP4) and range 5 (BP5). BP4 consists of the east three-quarters of the study area and BP5 the west quarter. BP4 includes sections N 1, 2, 3, part of 4, part of 9, 10, 11, all of 12 and 13 excluding their northeast quarters, 14, 15, 16 and part of 17 in Township 4, Range 5, West of the Fourth Meridian. BP5 includes part of section 4, 5, NE 7, 8, part of 9, 17, NW 35-41-5-W4, E 18-42-5-W4 and NE 32-41-5-W4.

2. DESCRIPTION OF THE STUDY AREA

2.1 Location

The Wainwright study area is located 22.5 km south of Wainwright, Alberta and 7.2 to 16.1 km east of Highway 41 (Figure 1). Canadian Forces Base Wainwright borders the north edge of the site. The study area covers 8.9 km east to west, 6.4 km north to south and occupies 4 468 ha.

The study area includes the following lands:

42-5-W4: N 1, 2-5, NE 7, 8-11, NW & S 12, NW & S 13, 14-17, E 18,
42-4-W4: part of NW 6,
41-5-W4: NE 32, 33, 34, NW 35.

2.2 Climate

The climate of the study area is typical of continental areas in northern latitudes. The winters are long, cold and dry while the summers are short and moderately warm. Temperature extremes of less than minus 40°C and greater than 30°C are possible (Atmospheric Environment Service 1982).

The prevailing winds are from the northwest; however, west and south winds are common. The Chinook belt does not extend to the Wainwright area, so temperatures during the winter are uniform.

In the Aspen Parkland region of Alberta the average annual precipitation is 450 mm. The mean precipitation during May through September is 300 mm (Strong and Leggat 1981).

The study area lies within the subhumid moisture region of Canada (Sanderson 1948). This region has an annual water deficit due to low humidity, frequent high winds and low precipitation. Although total summer precipitation is low in both the Aspen Parkland and Prairie Regions, a greater percentage falls during July and August in the Parkland. As well, 40 to 50% of the annual precipitation in the Parkland falls during the three summer months. These factors reduce moisture stress on vegetation and enable trees such as aspen to grow (Strong and Leggat 1981).

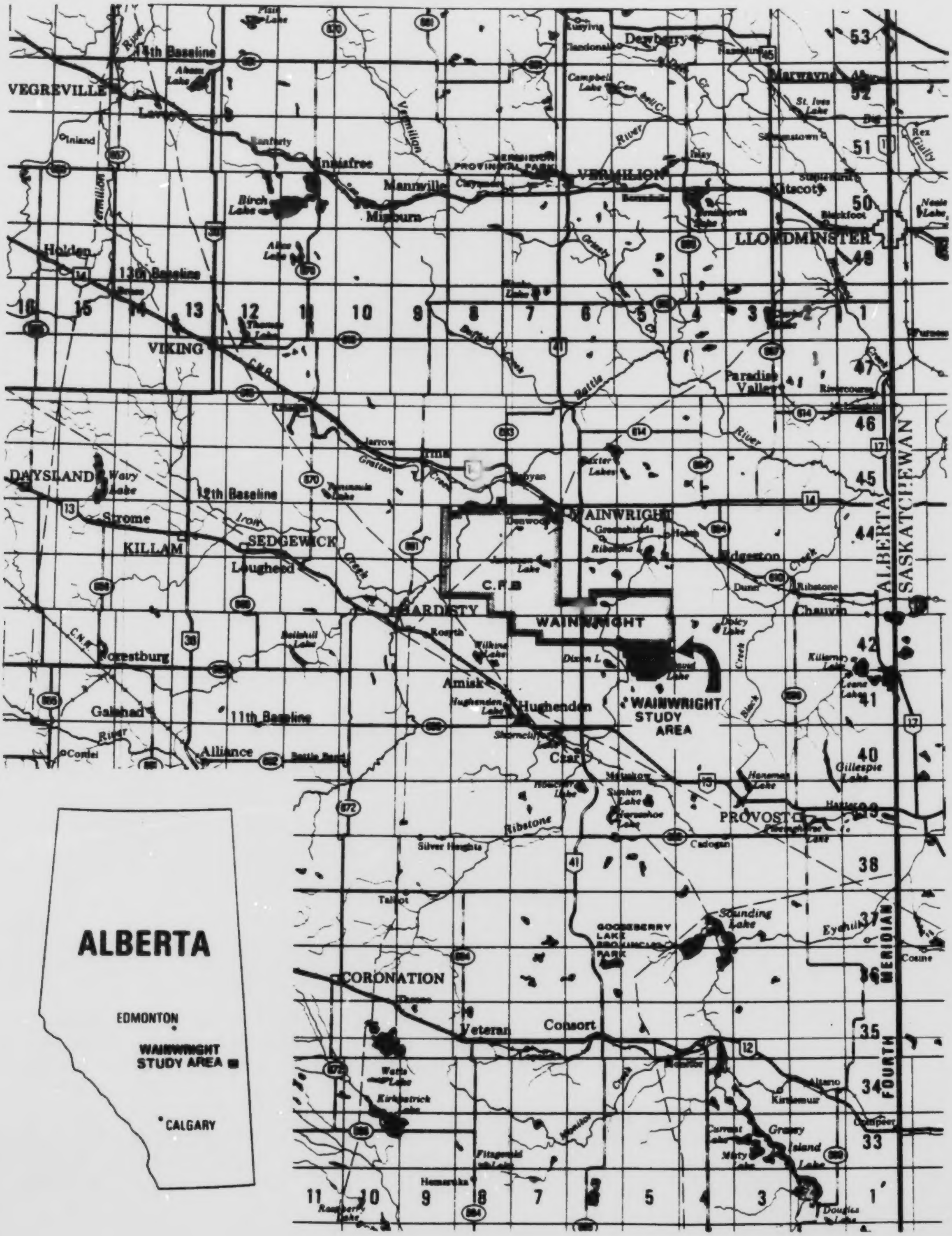

VEGREVILLE
Lavoy
Inland
14th Baseline
13th Baseline
12th Baseline
11th Baseline
Holden
Bruce
VIKING
Thomas Lake
Birch Lake
Innisfree
Ranfurly
Mannville
Minburn
Vermilion
VERMILION
VERMILION PROVINCIAL PARK
Clandonald
Dewberry
Campbell Lake
Marwayne
St. Ives Lake
Kitscoty
LLOYDMINSTER
Blackfoot
Paradise Valley
Rivercourse
Battle River
Iron Creek
Grattan Creek
Irma
Fabyan
Baxter Lakes
WAINWRIGHT
Denwood
Greenshields
Ribstone
Edgerton
Dunn
Chauvin
DAYSLAND
Wavy Lake
Strome
KILLAM
SEDGEWICK
Lougheed
HARDISTY
C.F.B. WAINWRIGHT
Dillberry Lake
Dixon L.
Forestburg
Galahad
Alliance
Battle River
Amisk
Hughenden
Hughenden Lake
Czar
WAINWRIGHT STUDY AREA
Metiskow
Sunken Lake
Horseshoe Lake
PROVOST
Hayter
Cadogan
Silver Heights
Ribstone
Talbot
GOOSEBERRY LAKE PROVINCIAL PARK
Sounding Lake
Eyehill
Cosine
CORONATION
Veteran
Consort
Monitor
Kirriemuir
Altario
Compeer
Watts Lake
Kirkpatrick Lake
Fitzgerald Lake
Current Lake
Grassy Island Lake
Douglas Lake
Roseberry Lake
Hemaruka
Gillespie Lake
Killarney Lake
Leane Lake
Hansman Lake
ALBERTA
SASKATCHEWAN
FOURTH MERIDIAN
53
52
51
50
49
47
46
45
44
42
41
40
39
38
37
36
35
34
33
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
ALBERTA
EDMONTON
WAINWRIGHT STUDY AREA
CALGARY

Figure 1. Location of Wainwright Study Area

[Scale 1:1 000 000 (from Provincial Base Map)]

▲—Hughenden Meterological Station

Listed in Table 1 are the long-term means from the Hughenden meteorological station. The station is located 22 km southwest of the study area.

2.3 Topography and Drainage

The study area is part of an undulating to rolling plain dissected by areas of deflated parabolic sand dunes (Figure 2).

The highest point in the study area is in the moraine northeast of David Lake, at an elevation of 724 m above sea level (ASL). The land slopes gradually to the south and west to Ribstone Creek. Ribstone Creek is the lowest point in the study area, at an elevation of 660 m.

The terrain in the east half to two-thirds of the study area is rolling and in the west third to one-half gently rolling. The southwest corner is undulating to level, but the land slopes down gradually to the Ribstone Creek valley, which touches the southwest boundary of the study area.

Aeolian deposits are found throughout the site. The dunes between Wallaby Lake in the northwest and David Lake in the southeast are aligned parallel in a northwest to southeast direction. Low, gently-rolling dunes are predominant south and east of Wallaby Lake, while west and northwest of David Lake dunes are steep and up to 30 m. Dunes with slopes up to 65% are common. Between the dunes are level areas that vary from less than one hectare to several hectares in size.

The study area is located within the North Saskatchewan River drainage basin. The east third drains into David Lake via a complex of fens, beaver ponds, streams and by ground water flow. From David Lake the water flows underground south to Black Creek. Black Creek runs into Ribstone Creek, which subsequently flows into the North Saskatchewan River via the Battle River. Most of the southwest area drains into Ribstone Creek directly. Wallaby Lake is a terminal basin.

Groundwater flow is an important means of drainage throughout the site as the soil is predominantly sand. Groundwater springs are responsible for the formation of the fen and beaver pond complex north and west of David Lake. One isolated spring was found north of David Lake. It runs over the surface for about 100 m before disappearing into the soil. This spring reportedly flows for much of the year.

2.4 Bedrock and Surficial Geology

In the east-central Alberta plains, the bedrock immediately below the unconsolidated material is part of the Upper Cretaceous Belly River Formation (Bayrock 1967). It comprises feldspathic sandstone,

Table 1

CLIMATIC AVERAGES FROM THE HUGHENDEN METEOROLOGY STATION

	Hughenden 52°31' N ; 110°58' W 694 m ASL
Mean annual temperature	2.0°C
Extreme maximum temperature	34.4°C
Extreme minimum temperature	-44.0°C
Annual precipitation	411.7 mm
Annual snowfall	98.9 mm
Annual rainfall	282.2 mm
Frost free period	97 days
Mean prevailing wind direction (mean speed)	NNW (15.9 km/h)
Annual potential evapotranspiration[1]	508 - 559 mm

1. Canadian Land Inventory (1978).

SOURCE: Atmospheric Environment Service 1982.

siltstone, mudstone, ironstone beds and thin coal seams and ranges from 274 to 295 m thick. The formation gradually dips to the southwest. There are no bedrock outcrops in the study area (Alberta Geological Survey 1972).

During the Keewatin glaciation, ice moved southwest from the Hudson Bay region carrying and mixing glacial till with the underlying bedrock. Mixed till deposited over the study area forms a mantle from 1 to 2 m thick to about 35 m thick. Outwash sand from glacial meltwater rivers is the main surficial deposit (Wyatt et al. 1944).

Parabolic dunes, formed by northwest paleowinds are the most important aeolian feature; David (1977) refers to them as the Buffalo Park Sandhills. They are part of a large complex of sandhills that extend east to the Saskatchewan border. They developed from the reworking of outwash deposits in the area after the recession of ice, but before the area was vegetated to any great extent. The dunes have not moved far from the source of sand deposits. Present activity is confined to blowout hollows in the south side of dune ridges where south winds breach the vegetation.

These dunes were described as longitudinal dunes in the past (Bayrock 1958), but the principle dune type has since been identified as a sand ridge of the North Battleford type. This latter type appears similar to a longitudinal dune; however, North Battleford dunes are formed by the transverse deflation of the southern wing of parabolic dunes. Consequently, the ridge is elongate with a slightly-sinuous crest-line and a strongly asymmetrical transverse profile. The ridges in the study area are parallel (David 1977).

In the northeast corner of the site is a small area of kame and disintegration moraine with moderate to high relief. The area immediately surrounding David Lake is part of an outwash - lacustrine complex. The grassland region in the western part of the site is an outwash plain.

2.5 Soils

The study area lies within the Dark Brown soil zone. The soil was formed on the glacial till deposited in the area; however, alluvial and aeolian deposits have been added recently. Throughout the area there are loose medium-grained sands. As a result, the soils have about 90% sand content and almost no structure. Sand in these proportions produces a soil that is well-drained and susceptible to erosion if there is no vegetative cover (Wyatt et al. 1944). Where organic content has built up in the soil, this aids to bind the soil particles together.

Figure 2. Surficial Geology

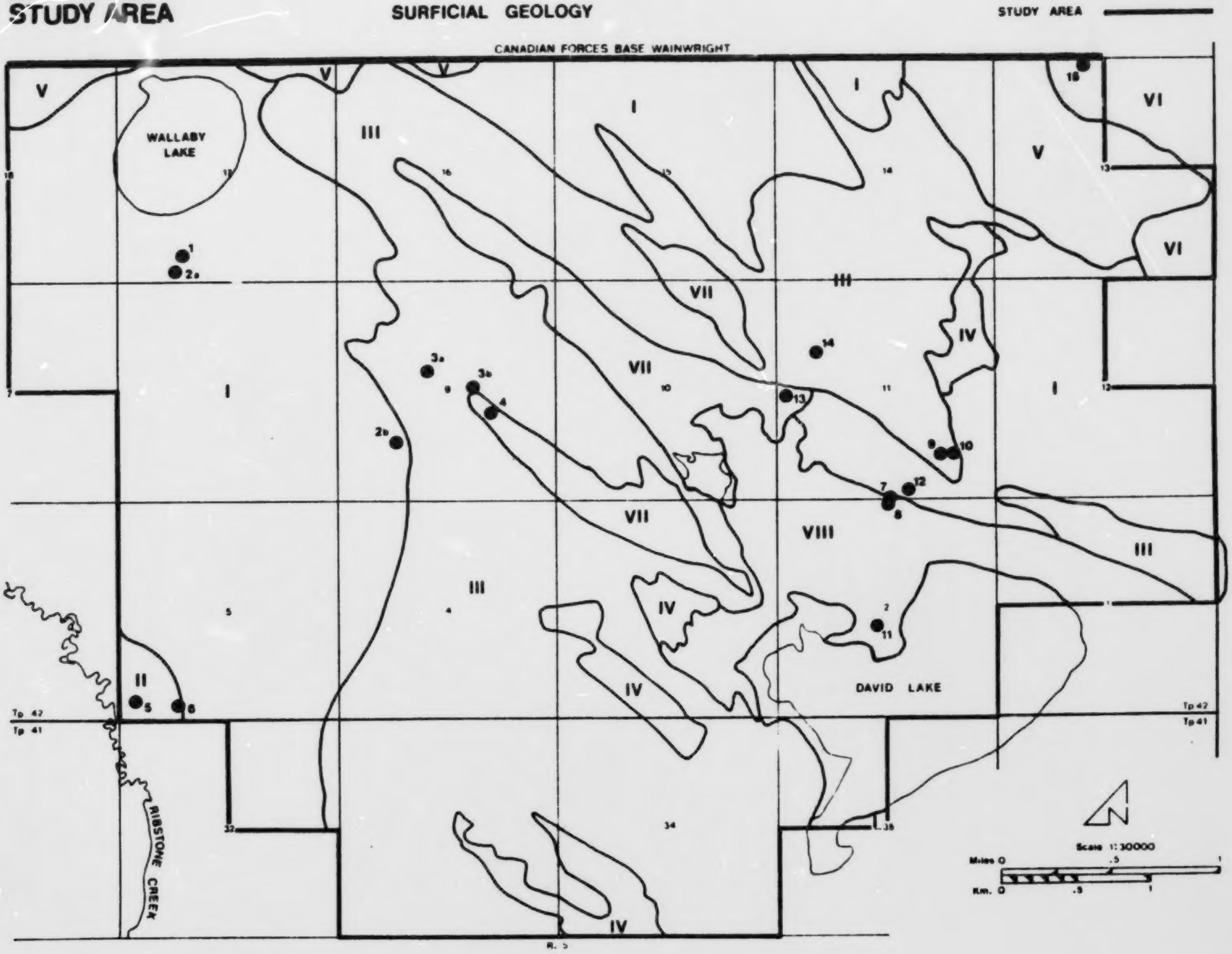
LEGEND

I	**Outwash plain**
II	Meltwater channel
III	Aeolian dunes
IV	Depressional aeolian
V	Kame moraine
VI	Ablation moraine
VII	Organic
VIII	Outwash - Lacustrine complex
5●	soil pits

FIGURE 2

WAINWRIGHT STUDY AREA

SURFICIAL GEOLOGY


STUDY AREA
CANADIAN FORCES BASE WAINWRIGHT
WALLABY LAKE
DAVID LAKE
RIBSTONE CREEK
I
II
III
IV
V
VI
VII
VIII
1
2a
2b
3a
3b
4
5
6
7
8
9
10
11
12
13
14
15
Tp 42
Tp 41
R. 5
Scale 1:30000
Miles 0 .5 1
Km. 0 .5 1

Dark Brown Chernozems are the principle soils on the uplands; however, in dune areas where vegetation is sparse Regosols and weak Chernozems are present. In depressional areas Regosols and Gleysols have developed. Regasols are associated with recent soil instability and tend to be sparsely vegetated, if at all. Gleysols develop where a water table is close to the surface. Organic soils are present in the deeper depressions where fens have developed.

Appendix 2 is a table of soil profiles in the study area as described by Wayne Tedder (Appendix 4).

2.6 History and Land Use

The original inhabitants of the Aspen Parkland were Plains Indians, a nomadic people who hunted the abundant wildlife. Bison, wapiti, pronghorn, mule deer, white-tailed deer, furbearers and the occasional moose were found in the region. Indians used fire as a means of communication and as a tool for modifying the movements of bison, their major food source. Their use of fire probably had the greatest impact on the land (Wroe 1971).

Anthony Henday travelled through the Battle and North Saskatchewan Rivers region in 1754 and 1755 in an attempt to persuade the Indians to bring their furs to Hudson Bay. Following Henday's journey, the Battle River became an important route for fur traders and trappers. In the late 1850's Captain John Palliser's expedition to the Canadian west for the British Government passed through the area (Morton 1963).

In the 17th and the 18th centuries, fur traders and bounty hunters were attracted to the Aspen Parkland because of the abundance of wildlife. In the late 1800s and early 1900s settlers moved into the area to homestead. By the late 1800s animals such as bison and wolf had disappeared (Bird and Bird 1967).

Agricultural settlement in the region began in the late 1880s and 1890s but the main settlement began after the arrival of the railways. The Dominion of Canada legal land survey in the region of the study area was completed by Fairchild and Fawcett in 1903 and 1904, respectively. In 1905 the Canadian Northern Railway went through from Lloydminister to Edmonton and settlement radiated north and south from the line. Settlement in the Wainwright area increased markedly in 1908 after the Grand Trunk Pacific Railway went through Wainwright to Edmonton (Gilt Edge Ladies Booster Club 1973). Within 10 years of the railway's arrival in Wainwright the sale of Crown land had almost stopped. By 1930 the sandhills area southeast of Wainwright was the only range land remaining (Wyatt et al. 1944).

The study area was originally used as open range by homesteaders in the area for their cattle and horses. A few homesteads were established in the area and some land was broken; however, during the drought of the 1930s the homesteads were abandoned and the land reverted to the Crown. The cultivated land returned to pasture (Maull 1983, pers. comm.).

The land continued to be used as free range until 1948 when the Buffalo Park Grazing Association (BPGA) was incorporated. In 1907, the region north of the study area was set aside as a reserve for Plains bison (Bison bison bison) and was called the Wainwright National Buffalo Park. In 1948 the park lands were transferred to the Province and a portion was leased back to the Government of Canada for use as a military base. Local public pressure for use of the former park lands for pasture resulted in Alberta Public Lands Division putting many sections of land in the region (including the study area) under reservation. The BPGA administers the land (Bradley and Bradley 1977).

No range management plan was ever established, and tally and supervision of the number of animal unit months (AUM) grazed was the responsibility of the BPGA.

In the late 1960s and early 1970s Public Lands Division and BPGA began making range improvements. This was an attempt to overcome the problems of brush invasion and overgrazing.

Between 1969 and 1971, 465 ha in BP5 (parts of Sections 4, 5, 8, 9 and 17) were spike cultivated and seeded with smooth brome, crested wheatgrass and alfalfa. Only the brome grass and alfalfa became established. BP5 was grazed continuously until 1978, when Public Lands temporarily suspended grazing because 88% of the range, both native and cultivated, was in fair to poor condition. When grazing resumes in 1984, it will be for fall grazing (late September to November) only. Carrying capacity for BP5 has now been set at 580 AUMs per year, compared with the 974 AUMs utilized in 1978. Over the past five years the area was grazed, but illegally (Adams and Tannas 1979).

In an effort to improve the range in BP5 a number of actions were taken in 1982 and 1983 (Figure 4). A new fence was erected between BP4 and BP5 that increased the size of BP5 by about 65 ha, a trail was cut down to Wallaby Lake to improve cattle access, about 40 ha of section 18 was burned to remove aspen poplar and about 32 ha (in two 16 ha parcels), were cultivated and seeded to grass and legumes. Seeding took place in 1983 (Loonen 1983, pers. comm.).

BP4 is the larger of the two ranges (about three times the area of BP5) and possesses a greater variety of range types. Until about 1979 cattle continually grazed the area. Livestock concentrated around David Lake, in wet meadows, and on the areas adjacent to these wetlands. Consequently, range condition in these areas was fair to poor, while overall most (75%) of the range was in fair to good condition (Adams and Tannas 1979).

In 1979 a range management plan was set up and improvements begun. A carrying capacity of 1 200 AUMs was established. This was lower than the 1978 stocking rate of 1 390 AUMs, but higher than the ten year average of 1 072 AUMs (Adams and Tannas 1979).

A rotational grazing system has been designed for BP4 to maximize livestock use. When the system is fully established the field west of David Lake and south of the large fen will be grazed during June and part of July. The David Lake pasture will be grazed from the middle of July to the end of August. For September the cattle will be in the dune area north of David Lake. Near the beginning of October the cattle will be moved to the northeast field of BP4. Two weeks later they will be moved to the southeast pasture. The cattle will be out of the study area by November 1.

This system is intended to provide for fall grazing of the dune and fen complex and summer grazing of the David Lake shoreline after waterfowl nesting is almost complete (Adams and Tannas 1979). Currently the David Lake area is grazed for part of June, July and August after which the cattle are moved north to the dunes for September and finally to the east fields for October (Maull 1983, pers. comm.).

To establish the rotational grazing system a number of changes have been made to the fields over the past few years (Figure 4). A north-south fence was constructed to divide range BP4 into two. The west field was divided into the David Lake field and dune field by building a cross fence. An east-west cross fence was built in the east field to divide it into north and south pastures. A cross fence will be built from the northwest corner of David Lake northwest to the large fen to divide the David Lake pasture into two pastures. Three dugouts were built in the dune area to distribute livestock more evenly. Prior to 1983 approximately 65 ha of aspen were cleared in Section 13 to increase forage production. A further 115 hectares of aspen forest are to be brushed during the winter of 1983 and 1984 (Loonen 1983 and Maull 1983, pers. comm.).

Future plans for both BP4 and BP5 include clearing or spraying bush, and seeding and regrassing the abandoned cultivation and overgrazed grasslands.

Development of an oil field in the Wainwright area began in about 1920. Since then oil and gas fields have been discovered and developed (Wyatt et al. 1944). Five gas wells have been drilled in the study area: three have been abandoned and two capped.

In the mid 1970s an inventory of parks and natural areas suitable for recreation or preservation was undertaken by the Natural Areas Program of Alberta Energy and Natural Resources, Public Lands Division and the Resource Assessment Group of Alberta Recreation and Parks. They found that of the existing areas reserved for preservation or recreation, less than 0.1% was in the Aspen Parkland Ecoregion, even though it is the most populated and accessible region in Alberta and contributes over 11% of Alberta's land area (Fehr 1982).

Areas representative of the region and large enough to withstand recreational use were sought. Three areas of 39 km^2 (15 sections) or more (totalling 350 km^2 or 135 sections) were found, Rumsey, Bodo, and Wainwright. The Rumsey block is the largest (233 km^2) and most representative. An area of 3 445 ha has been nominated as a supplementary ecological reserve. The Wainwright block is smaller (about 52 km^2), but since its features complement those of Rumsey it was rated as having the potential to be a supplementary ecological reserve with special characteristics. The Bodo block was not looked at in detail.

2.7 Vegetation

The Aspen Parkland Region has been variously described as a transition zone between the Boreal Forest and the prairie, a subclimax ecotone, and a complex of forest communities in grassland. Moss (1932) adhered to the former description. He divided what is now known as the Aspen Parkland Ecoregion into the poplar association and the grove belt. The latter consists of a patchwork of aspen groves and prairie grassland, while the poplar association predominantly consists of aspen forest. In the northern part of the region Moss (1932) considered Picea glauca (white spruce) to be the climax species.

The Aspen Parkland was regarded as a subclimax ecotone between the coniferous forest and the prairie by Bird (1930). Coupland and Brayshaw (1953) described the Parkland as an interspersion of forest communities in grassland; however, they considered the ecotone to exist around each individual aspen grove, rather than at the interface of the northern forest and prairie.

Moss (1932) recognized two major vegetation types in the Aspen Parkland: the aspen community of moist and sheltered sites, and the prairie complex of drier and more exposed sites. In Alberta, north and south regions of the prairie are distinguished. They coincide with the Dark Brown and Brown soil zones, respectively. The grassland of the Parkland is described by Moss as northern prairie with islands of southern prairie interspersed. Festuca scabrella (rough fescue) and Koeleria cristata (June grass) are the predominant northern prairie species and Agropyron spp. (wheatgrasses), Bouteloua gracilis (blue grama) and Stipa spp. (needle grass) are important constituents of the southern prairie.

The fescue grassland was not recognized as a distinctive vegetation type until recently. Moss (1932) was one of the first to recognize Festuca scabrella as an important grass of the Parkland. The fescue grassland was later described as the Festuca-Danthonia association, first by Clarke, Campbell and Campbell (1942) and then by Moss (1944). Moss and Campbell (1947) concluded that the proper name for the association was Festuca scabrella and that it needed no further subdivision. Studies by Coupland and Brayshaw (1953) led them to concur with the decision of Moss and Campbell. Festuca scabrella is now known to be the dominant grass in the Parkland of Alberta and Saskatchewan and in the Cypress Hills.

Aside from *Festuca scabella*, the major grass species found in the fescue grassland are *Agropyron* spp., *Danthonia intermedia*, *Festuca saximontana*, *Koeleria cristata* and *Stipa spartea* var. *curtiseta* (Smoliak *et al*. 1976).

On uplands with sandy loam soil, as is found in the study area, vegetation is comprised of *Bouteloua gracilis*, *Calamovilfa longifolia*, *Koeleria cristata*, *Sporobolus cryptandrus*, *Stipa comata* and *Stipa spartea* var. *curtiseta*. The major species on sandhills and stabilized dunes are *Agropyron dasystachyum*, *Calamovilfa longifolia*, *Elymus canadensis*, *Oryzopsis hymenoides*, *Sporobolus cryptandrus* and *Stipa comata* (Smoliak *et al*. 1976).

The largest number of sand dune complexes in Canada are found in northern Alberta. There are notable differences in the vegetation of these northern dunes and the vegetation of the Wainwright Sandhills. This is due in part to the location of the latter dunes in the Central Parkland. In contrast to the northern dunes, which are vegetated primarily with *Pinus banksiana* (jack pine), the dunes in the study area are treed with aspen. As well, the interdune depressions in the Wainwright Sandhills are drier and, while there are fens in some of the lower spots, most of the depressions are vegetated with Parkland species. They also lack coniferous tree cover.

The depressional areas in northern dune complexes are usually fens which may or may not be treed. *Betula* spp. (dwarf birch), *Carex* spp. (sedges), *Salix* spp. (willows) and *Sphagnum* spp. are common constituents of these fens (Lee 1980). Treed fens may have a coniferous cover of *Picea mariana* (black spruce) and/or *Larix laricina* (tamarack). *Betula papyrifera* (paper birch) may also occur.

Hulett *et al*. (1966) studied the relationship of dune vegetation to physiographic positions in the Dark Brown soil zone in Saskatchewan in the Dundurn Sandhills. Species composition of these sandhills is quite similar to that of the Wainwright Sandhills. In the Dundurn Sandhills the principle species of actively eroding sand dune complexes are *Agropyron* spp., *Calamovilfa longifolia*, *Helianthus petiolaris*, *Lygodesmia juncea* and *Psoralea lanceolata*. Most of the species in this habitat are perennials. Important species in stabilized blowouts, or deflations, include *Agropyron* spp. *Arctostaphylos uva-ursi*, *Carex heliophila*, *Juniperus horizontalis* and *Selaginella densa*. Only five of the major taxa of active complexes are important components of stabilized blowouts. They include *Agropyron* spp. *Calamovilfa longifolia*, *Chrysopsis villosa*, *Koeleria cristata* and *Psoralea lanceolata*. On stabilized dunes, shrubs such as *Prunus virginiana* and *Symphoricarpos occidentalis* are common. Other common species include *Artemisia frigida*, *Koeleria cristata*, *Selaginella densa* and *Stipa comata*. Hulett did not report finding any coniferous trees in the area he studied.

The upland vegetation of sandhills in central Alberta, north of Edmonton, is similar to northern dunes. It was described by Dowding (1929) as predominantly jack pine and mosses or jack pine and heath (*Vaccinium* spp. and *Arctostaphylos uva-ursi*).

In the depressions between the sandhills, Dowding described a swamp vegetation that includes several moss species, *Aster junciformis*, *Betula glandulosa*, *Calamagrostis inexpansa*, *Carex diandra*, *Galium trifidum*, *Habenaria hyperborea*, *Menyanthes trifoliata*, *Salix pedicellaris*, *Triglochin palustris* and *Utricularia intermedia*. Muskeg vegetation surrounds the swamp region. *Picea mariana*, *Ledum groenlandicum*, *Vaccinium vitis-idaea*, *Carex rostrata*, *Carex paupercula* and *Sphagnum magellanicum* are the dominant species in the muskeg. *Alnus* thickets and jack pine - white birch stands ring the muskeg.

Moss (1953) considered the *Drepanocladus* - *Carex* bog to be an important and basic vegetation type in central Alberta, especially in depressions between sandhills. This vegetation type is similar to the fen vegetation of the Wainwright Sandhills. The *Drepanocladus* - *Carex* bog develops in depressions that contain marsh and aquatic vegetation. The stages of succession that Moss described correspond to community types found in the study area with the exception of many boreal species he found which are not present in the area.

In the initial development of a bog or fen, the perimeter of a marsh is a floating mat, 0.3 - 0.6 m above the water, vegetated with tussocks of *Carex diandra* and *Carex lasiocarpa*, and low-lying mats of *Drepanocladus* spp. Other species present include *Aster junciformis*, *Betula glandulosa*, *Calamagrostis inexpansa*, *Menyanthes trifoliata*, *Potentilla palustris* and *Salix pedicellaris*. Gradually a shrub strata develops consisting of *Betula glandulosa* and *Salix pedicellaris*: grasses, especially *Muhlenbergia glomerata*, develop as an important part of the ground layer. In some bogs of this type tree species such as *Betula papyrifera*, *Larix laricina*, *Picea mariana*, *Pinus banksiana*, *Populus balsamifera*, *Populus tremuloides* and *Salix* spp. are occasionally found. Other grasses present include *Agrostis scabra* and *Calamagrostis inexpansa*. Principal forbs include *Aster junciformis*, *Menyanthes trifoliata*, *Parnassia palustris*, *Potentilla norvegica*, *Potentilla palustris*, *Rubus acaulis* and *Stellaria longifolia* (Moss 1953).

Further succession can lead to a *Sphagnum* - *Ledum groenlandicum* - *Picea mariana* community type or a *Larix lariciana* community type.

Moss (1953) described the *Drepanocladus*-*Carex* association as a bog; however, recent studies indicate that there are few if any true bogs in Alberta due to the calcareous nature of the bedrock and groundwater, and to the continental climate. Most peatlands occurring in the province are actually fens (Vitt *et al*. 1975).

Bogs and fens are differentiated on the basis of pH, cation concentration, conductivity and species richness. Bogs receive moisture only from precipitation (ombrogenous water) while fens receive most of their moisture from groundwater. Since groundwater is in contact with the mineral soil, the water in fens is relatively rich in nutrients (minerotrophic) and in contrast to ombrogenous water contains nutrients which are available for plant growth (Horton *et al*. 1979). Fens are further divided into poor, medium (or transitional) and rich fens.

Species richness refers to the number of indicator species present in a fen community. Indicator species are indicative of high cation concentrations and a high pH; a high species richness is characteristic of rich fens (Horton et al. 1979). Mosses and carices are the most sensitive plant indicators of water chemistry differences (Slack et al. 1980).

Patterned fens (also called aapamires or strangmoor) are found in a narrow band of peatlands across Canada just below the discontinuous zone of permafrost under continental climatic conditions. Patterning is characterized by the development of raised peat ridges, or strings, alternating with water-filled depressions, or flarks. The strings can be almost parallel or in a reticulate pattern (Slack et al. 1980) and are usually oriented perpendicular to the direction of water flow. Patterning develops best in poor fens (Vitt et al. 1975).

Study of patterned fens in Alberta has increased over the past few years but most have been conducted in the foothills (e.g. Lewis et al. 1928 and Slack et al. 1980) and boreal forest (Lewis et al. 1928, Moss 1953, Vitt et al. 1975, Horton et al. 1979 and Lee et al. 1982).

Although the Wainwright Sandhills contain patterned fens as well as some of the most extensive fens in the Parkland, they have not been studied except for a general report written on the Wainwright Sandhills for Alberta Parks by Bradley and Bradley (1977).

3. METHODS

3.1 Flora and Vegetation

The field research for this report was conducted during May, June and July, 1983.

A floral list was compiled by identifying, or collecting for later identification, all species observed. Voucher specimens were collected for verification and deposition in the herbaria of the Alberta Provincial Museum (PMAE) and Alberta Energy and Natural Resources. Vascular plants were identified in the field by the author. Vascular plant verifications were done by C. Tannas, mosses were identified by Dr. D. H. Vitt and lichens were identified by M. Ostafichuk. Nomenclature for vascular plants follows Moss (1959), for most mosses Ireland (1982) and for lichens, Hale and Culbersen (1970).

The plant community types were described on the basis of field vegetation surveys. Dominant species, based on their canopy cover, were the basis for describing each community type. Community types in the study area were tentatively identified by a rapid field survey and from those identified in literature available on the area. Relatively homogenous stands of each community type were selected from aerial photographs and field inspections.

Because of time constraints only about three to six communities of each community type could be surveyed. If a community type in the study area was similar to one in the Rumsey Candidate Ecological Reserve (Fehr 1982) fewer communities were surveyed.

The communities, or stands, to be surveyed, were chosen to represent a variety of geographical positions. Stands varied in size, depending on the characteristics of the community. Most stands were inspected in mid-June and again in late July so that both early and late blooming species could be recorded. An example of the stand description sheet used is included in Appendix 3. This is the standard form used for vegetation surveys by the Natural Areas Program.

Within each stand, cover was estimated for each layer and for each species within a layer. Cover refers to the mean cover of a species within a strata or of a strata within a community in each community type. Five layers were recognized:

1. Tree layers,
2. Tall shrub layer: Woody plants 2 to 5 m tall,
3. Low shrub layer: Woody plants 0.5 to 2 m tall,

4. Herb-dwarf shrub layer: Woody plants less 0.5 m tall and all herbs,
5. Bryoid layer: all mosses and lichens.

Cover values were also estimated for rock, humus, mineral soil, deadfall and water. The following physical features were noted for each stand: elevation ASL, landform, topographic position, slope, aspect, microtopography, moisture regime and soil class.

The area occupied by each vegetation type was determined by measuring on aerial photographs the proportion of each type along transacts through the study area. Not all community types could be delineated on photographs, therefore, some were lumped together. Balsam poplar and aspen were lumped together as poplar and all grassland community types and shrub community types in grasslands were simply indicated as grasslands. The transects were located along road allowances bordering and crossing the study area. Transects totalling 44.2 km were measured on 1982 black and white photographs (Scale: 1 : 30 000).

The transects used in this study were chosen to correspond to the transects Fairchild and Fawcett surveyed in 1903 and 1904, respectively, for the Dominion of Canada legal land survey. Since the surveyors measured the amount of water, fen, willow, grassland, scrub poplar and poplar stands along each transect brush invasion of the grasslands was determined by comparing the percentage of brush on the transects in 1903 and 1904 to that in 1982.

3.2 Terrain and Soils

Two days in July 1983 were spent investigating the terrain and soils in the study area. Seventeen sites were visited. At most sites detailed information on the topography, parent material and soil profile was collected. The different landscapes were mapped on 1 : 30 000 aerial photography.

Wayne S. Tedder of the Alberta Public Lands Division conducted the investigation. His report is included as Appendix 4, the soil profiles are listed in Appendix 2 and the surficial geology map is presented in Figure 2.

3.3 Fauna

Species lists were compiled for mammals, birds, reptiles and amphibians based on field observations and records from the literature. Nomenclature for the mammals follows Banfield (1974), for birds Salt and Salt (1976) and the American Ornithologists' Union (1982), and for reptiles and amphibians, Cook (1980).

Wildlife was observed and identified while doing vegetative field work. Bird surveys were undertaken during May, June and July, 1983. Particular habitats or areas were searched and all birds seen or heard were recorded.

3.4 Disturbed Sites

Disturbed areas are defined as sites that have been altered from their natural state by man. They were identified on aerial photographs, ground-truthed and then mapped. Disturbances discovered while doing field work were also mapped.

3.5 Special Features

Plants, animals and geographical features considered to have special importance were identified and mapped. Features were considered special if they were rare or uncommon outside the study area, or if they represented some other unusual aspect.

4. FLORA

The vascular flora of the Wainwright study area consists of 406 species distributed among 62 families and 205 genera. Species-rich Families include Compositae with 55 species, Graminae with 52, Cyperaceae with 39, and Leguminosae, Ranunculaceae, Cruciferae and Salicaceae with 18, 17, 16 and 15 species, respectively. *Carex* is the most species-rich genera with 26 species. Other species-rich genera include *Salix* (13), *Potentilla* (9), *Ranunculus* (9), *Agropyron* (8), *Potamogeton* (7), *Solidago* (7) and *Equisetum* (6).

The non-vascular flora consists of 81 species of which 31 are lichens and 50 are bryophytes. Species-rich lichen genera include *Cladonia* with 9 species, *Cetraria* with 5, *Parmelia* with 4 and *Physcia* with 3. Species-rich bryophyte genera include *Sphagnum* (5), *Campylium* (4), *Dicranum* (4), *Brachythecium* (3) and *Drepanocladus* (3).

Appendix 5 is an annotated list of the non-vascular and vascular plants found in the study area.

Two species found in the study area, *Gentiana fremontii* and *Ruppia occidentalis*, are considered rare by Argus and White (1978). Packer and Bradley (1978) also consider *Ruppia occidentalis* rare. As well, they consider *Carex interior*, also found within the study area, to be rare. Several species are considered uncommon by Packer and Bradley (1978). These include *Asclepias ovalifolia*, *Carex livida*, *Carex parryana*, *Drosera anglica*, *Eriophorum chamissonis*, *Lobelia kalmii*, *Lycopus americanus*, *Opuntia fragilis*, *Potamogeton zosteriformis* and *Psoralea argophylla*.

5. VEGETATION

The diversity of landforms in the study area is reflected in the diversity of plant community types present.

Grasslands make up approximately one-third of the site and are generally found on the drier south-facing slopes of hills and on the undulating plain in the west half of the study area. Major grass species include *Bouteloua gracilis*, *Calamovilfa longifolia*, *Festuca scabrella*, *Koeleria cristata* and *Stipa spartea* var. *curtiseta*.

Within the grasslands two shrub community types are recognized. The *Elaeagnus commutata*-*Symphoricarpos occidentalis* (wolf willow - buckbrush) community type (CT), found only in a few locations, is usually associated with the aspen - grassland interface. *Symphoricarpos occidentalis* CT is found throughout the study area in mesic sites.

Typical groves of aspen grow on mesic north-facing slopes of hills and dunes and in mesic depressions. These stands have well-developed shrub and forb layers. Scrub aspen groves are found on relatively xeric aeolian dunes and plains. In constrast with typical aspen groves, these scrub groves lack well-developed shrub layers, the forb layer has a different species composition, and growth of the aspen trees is stunted.

In dune areas the vegetation varies according to the site. Blowout areas are sparsely vegetated with lichens, grasses, herb and *Carex* (sedge) species. The vegetation of interdune depressions varies from scrub aspen stands discussed above to sparse herb-bryophyte stands similar to those found in blowouts.

Vegetation is similar for all fens in the study area. Low shrubs, such as *Betula pumila* (dwarf birch) and *Salix candida*, form a well-developed shrub layer II. The herb-dwarf shrub and bryophyte layers are species rich. Plant species are distributed throughout the fens along moisture and mineral gradients.

Slough, lake and beaver pond edges are ringed with sedges, *Scirpus* spp., *Glyceria grandis* and an assortment of hydrophyllic herbs and grasses. The vegetation of shallow marshes or wet meadows includes sedges, *Mentha arvensis*, *Poa palustris* and *Potentilla anserina*. Saline slough edges are dominated by salt tolerant species such as *Distichlis stricta*, *Puccinellia nuttalliana* and *Scirpus americanus*.

Salix (willow) stands occupy banks of sloughs. The willows usually form a dense canopy under which lies a sparse herb layer.

The wetland community types are under constant pressure from willows that ring the slough. Dry years allow willow stands to encroach into the slough; wet years drown the saplings and keep the spread of willows in check.

Willow stands are usually ringed with Populus balsamifera (balsam poplar) stands. These stands are generally mesic and support rich layers of shrubs and herbs. Aspen may be a co-dominant along with balsam poplar.

The location of the surveyed communities are shown in Appendix 6. Individual stand species lists and cover values are listed in Appendix 7.

5.1 Aeolian Dune Complex

The dune complex was divided into five physiographic categories to simplify the sampling and description of the area. The terminology corresponds roughly to that used by Hulett et al. (1966) to describe dune vegetation in Saskatchewan; however, the criteria used in defining the landforms was adapted for use in the Wainwright Sandhills.

(a) Active blowouts - saucer-shaped depressions formed by the deflation of sand through a breach in the vegetation cover (David 1977) and showing signs of active erosion or deposition.

(b) Stabilized blowouts - similar to active blowouts in that there has been recent erosion, but none is occurring at present.

(c) Dune ridge - of the North Battleford type showing the charactristic dune form (David 1977) and showing few signs of erosion aside from some blowout hollows on the south sides.

(d) Interdune depressions - depressions between two parallel dune ridges, no recent erosion.

(e) Sand flats - level to undulating areas of aeolian sand deposits between areas of dune ridges, no recent erosion.

5.1.1 Blowouts

Blowouts (active and stable) develop most often on the south and southwest sides of dunes but they also develop in undulating areas where there is little relief. The sites are xeric to very xeric due to the southern aspect, rapid drainage through the sand substrate and lack of vegetative cover. Soils are Orthic Regosols.

Active blowouts include Stands 4, 17, 28 and 40. Stable blowouts include 14, 15, 31, 36 and 37.

Active and stable blowouts differ in their vegetative cover; however, neither are static community types. The vegetation can be described in terms of its change over time beginning with the initial establishment of vegetation on the sand substrate of an active blowout.

Initial colonization of blowouts begins with sedge and grass species, followed by the growth of lichens and a denser herb-dwarf shrub layer. Canopy cover of the herb-dwarf shrub layer is 22.5% (10 - 30%) in active blowouts, compared to 45.0% (30 - 60%) in stable sites. Bryoids have a low cover value (less than 1%) in active sites, but have 48% (25 - 60%) cover in stable sites. Differences in canopy cover are reflected by the differences in humus and mineral soil cover in the two community types. Humus cover averages 3.8% (1 - 5%) and mineral soil cover averages 88.8% (80 - 95%) on active sites, while on stable sites humus cover increases to 20.0% (10 - 30%) and mineral soil cover decreases to 39.6% (3 - 55%).

Species richness increases as blowouts are stabilized. Species richness ranges from four species in an active blowout to 27 species in a stabilized blowout. Active sites average 10.5 (4 - 17) species and stabilized sites average 17.8 (13 - 27) species. Bryoids account for much of the difference in species richness.

Most of the plants found in active stands are important colonizers of bare sand. Dominants include *Carex foenea* with 5.3% cover, *Calamovilfa longifolia* (3%), *Elymus canadensis* (2%), *Oryzopsis hymenoides* (2%), *Festuca saximontana* (1%) and *Chrysopsis villosa* (0.6%).

Several of the species listed above are also dominant in stabilized blowouts. These include *Calamovilfa longifolia* (8.0% cover), *Carex foenea* (6.0%) and *Festuca saximontana* (5.2%). Other important species in stable blowouts include *Selaginella densa* with 4.3% cover, and *Carex obtusata* and *Koeleria cristata* each with 1.8% cover. *Juniperus horizontalis* is an important colonizer and stabilizer of eroded areas because it creeps in from outside the blowout and takes root. In active blowouts it has a cover of 4% while in stabilized blowouts it increases to 16%.

Hudsonia tomentosa, a boreal species, is found in both active and stable blowouts. It reaches its southern limit in eastern Alberta in the Wainwright Sandhills.

Seven of the nine bryoid species in stable blowouts are lichens. They cover almost half the ground in stable blowouts and help to prevent erosion, to build up soil and to protect seedlings. The dominant lichen is *Cladonia mitis* (27% cover). Other lichens present are *Cornicularia aculeata*, *Cetraria ericetorum*, *Cetraria nivalis*, *Cladonia chlorophaea* and *Parmelia chlorochra*. The moss, *Tortula ruralis*, is found in both active and stable stands.

One shrub species, *Prunus virginiana*, was found with low (1%) cover in an active blowout. Stunted aspen and *Salix bebbiana* formed a shrub canopy in a stable blowout. It appears that as shrub canopys develop the moisture regime in a community becomes less xeric and allows an aspen stand to gradually develop. Aspen stands in blowout depressions were not sampled but were observed on several occasions.

5.1.2 Interdune Depressions

Plant communities in interdune depressions face a less severe physical environment than do blowout communities, consequently, the vegetation is more developed. Interdune depressions have a greater species richness. The shrub layers consist of more species, most of which also have a higher cover value.

Stands 3, 16, 30 and 41 are in interdune depressions.

Interdune depressions are moderately well to rapidly drained, thus producing a xeric moisture regime. The soils are Orthic Regosols. Humus cover averages 31.5% and mineral soil cover 16.8%.

A well-developed low shrub layer is characteristic. Aspen is the dominant species (21.3% average cover), averaging 1.6 m in height. In one stand aspen formed a shrub layer I as well. Aspen rarely forms a tree canopy in interdune depressions as the xeric conditions stunt its growth. Other species present in shrub layer II are Betula papyrifera, Rosa acicularis and Salix bebbiana. Cover of this layer averages 23.8% (20 - 30%).

The herb-dwarf shrub layer has a mean cover of 40% (20 - 65%). Juniperus horizontalis (20.0% cover), Selaginella densa (8.3%) and Calamovilfa longifolia (7.5%) are the dominant species. Other species prevalent include Spiraea alba (3.8%), Arctostaphylos uva-ursi (3.0%), Juniperus communis (2.5%), Festuca saximontana (2.1%) and Juncus balticus (1.6%). The cover of Carex foenea appears to drop as the vegetation develops beyond the stable blowout stage. The cover of Carex foena averages 6.0% in a stable blowout compared with the 1.5% average cover in interdune depressions. Hudsonia tomentosa is found in interdune depressions and on the sides of dune ridges.

Bryoids form an extensive ground mat in these stands. Cover averages 47.5% (30 - 60%). Cladonia mitis (33.5% average cover) is the dominant species of this layer. Other important species are Cetraria nivalis (4.3%), Cladonia uncialis (2%), Cladonia pyxidata (2%), Cetraria ericetorum (1.8%) and Corniculoria aculeata (1.1%).

5.1.3 Dune Ridges

An aspen stand with a thick shrub layer is the main vegetation type found on the north side of dunes. This vegetation type is discussed further under 5.3 Aspen Community Types.

A variety of vegetation types adapted to xeric conditions grow on the south side of dunes. In blowout hollows located on dunes, typical blowout vegetation is found. Vegetation typical of interdune depressions often grows on the lower and middle slopes of dunes.

Stunted aspen is sometimes found growing on south slopes, but only in the more mesic sites. Common shrubs are *Prunus virginiana*, *Rosa arkansana* and *Rosa woodsii*. The dwarf shrubs *Arctostaphylos uva-ursi*, *Juniperus communis* and *Juniperus horizontalis* provide important cover on the dunes.

Agropyron subsecundum, *Calamovilfa longifolia*, *Elymus canadensis*, *Festuca saximontana*, *Koeleria cristata* and *Stipa spartea* var. *curtiseta* are grasses found on the south slopes of dunes. Common herbs include *Artemisia campestris*, *Artemisia frigida*, *Artemisia ludoviciana*, *Chamaerhodos erecta*, *Chrysopsis villosa*, *Equisetum hyemale*, *Erysimum asperum*, *Gaura concinna*, *Lygodesmia juncea*, *Selaginella densa* and *Thermopsis rhombifolia*. *Rhus radicans* and *Opuntia fragilis* are locally abundant throughout the study area, occurring primarily on the south slope of dunes. *Cladina mitis* is the dominant lichen while *Tortula ruralis* is the dominant moss.

5.1.4 Sand Flats

Aspen stands and grasslands occupy sand flats. They are discussed further under sections 5.3 Aspen Community Types and 5.2 Grasslands respectively.

5.2 Grasslands

Grassland communities are found throughout the study area on aeolion sand deposits, kame and disintegration moraines, outwash plains and lacustrine deposits. Most stands occur on level to undulating terrain or on south- (occasionally east and west) facing slopes. Soils are Dark Brown Chernozems, which are moderately well to rapidly drained. The moisture regime is xeric to subxeric.

Stands 1, 11, 12, 26, 27, 35, 42, 49, 50 and 52 are grassland communities.

Species composition of grassland communities varies considerably within the study area. On the xeric sand flats (Stands 27 and 52) and the outwash plain (Stands 11 and 12) dominant species include *Calamovilfa longifolia* (15.0% average cover), *Artemisia frigida* (11.3%), *Koeleria cristata* (8.8%), *Festuca saximontana* (8.0%) and *Festuca scabrella* (6.3%). Species such as *Anenome patens*, *Antennaria nitida*, *Chamaerhodas erecta*, *Chrysopsis villosa*, *Gaillardia aristata*, *Juniperus horizontalis* and *Rosa arkansana* occur in these stands. The canopy cover of *Selaginella densa* averages 27.5%. This species provides important ground cover for stands that are dry and often poorly vegetated. Herb-dwarf shrub cover averages 56% (40 - 70%).

Other species of note on sand flats and the outwash plain include *Opuntia fragilis* (prickly pear cactus), *Rhus radicans* (poison ivy) and *Mirablis hirsuta* (umbrellawart).

Stands 11 and 12 are adjacent; however, Stand 12 was disturbed about 10 years ago when it was spike cultivated. Stand 12 has less humus cover, less canopy cover and more exposed mineral soil than Stand 11.

Bryoid cover is the highest in stands on sand flats and on the outwash plain. Stands 11 and 12, with 65% and 60% cover respectively, have the highest bryoid cover. Stand 27 has 35% and Stand 52 has 10% bryoid cover. The lichen flora of these grasslands is similar to that in blowouts and interdune depressions. *Cladonia mitis* and *Cladonia pyxidata* are the dominant species, but *Cetraria ericetorum*, *Cetraria nivalis*, *Cornicularia aculeata* and *Parmelia chlorochra* are also present in these stands.

In moist grasslands the cover of the herb-dwarf shrub layer increases, bryoid cover decreases and the cover values of species that thrive under moister regimes, such as *Stipa spartea* var. *curtiseta* and *Thermopsis rhombifolia*, increase. *Cetraria ericetorum*, *Cladonia mitis* and *Cladonia pyxidata* are the only lichens present.

The grassland communities located on the kame moraine (Stands 1 and 50) are more typical of Parkland grasslands. Stand 1 is situated on a southwest slope near the crest of the hill. *Antennaria nitida*, *Artemisia frigida*, *Carex eleocharis*, *Koeleria cristata*, *Selaginella densa* and *Stipa spartea* var. *curtiseta* are all important species with high cover values. Other species present, but with lower cover values, include *Astragalus flexuosus*, *Bouteloua gracilis*, *Danthonia intermedia*, *Festuca scabrella*, *Oxytropis campestris* and *Thermopsis rhombifolia*.

Stand 50 is a more mesic community situated at the base of a hill with a southwest aspect. The major differences between Stand 1 and 50 are the presence of shrubs and a slightly higher herb canopy cover (80% versus 75%) in Stand 50. There are differences in species composition and Stand 50 lacks a bryoid cover.

In Stand 50 *Symphoricarpos occidentalis* and *Rosa woodsii* have cover values of 20% and 5%, respectively.

The dominant forb species in Stand 50 are *Carex* spp., *Danthonia intermedia*, *Festuca scabrella*, *Koeleria cristata* and *Stipa spartea* var. *curtiseta*. Species with lower cover, but which frequently occur include *Agropyron subsecundum*, *Artemisia frigida*, *Artemisia ludoviciana*, *Bouteloua gracilis* and *Galium boreale*.

As Stand 50 is more mesic than Stand 1, xerophyllic species such as *Antennaria nitida*, *Artemisia frigida*, *Koeleria cristata*, *Oxytropis campestris*, *Selaginella densa*, *Stipa spartea* var. *curtiseta* and *Thermopsis rhombifolia* are either absent or their cover value is lower than that in Stand 1. Species present in Stand 50 only, or that have a higher cover value in this stand include *Agropyron subsecundum*, *Artemisia ludoviciana*, *Danthonia intermedia*, *Festuca scabrella*, *Galium boreale*, *Orthocarpus luteus* and *Penstemon gracilis*.

Total cover of the bryoid layer in Stand 1 averages 3%. Lichen species in this stand include the species commonly found under xerophytic conditions elsewhere in the study area: *Cetraria nivalis*, *Cladonia chlorophaea*, *Cladonia mitis*, *Cladonia pyxidata* and *Parmelia chlorochra*. Bryoids were not recorded in Stand 50.

The upland immediately surrounding David Lake is predominantly grassland. Cattle concentrate near David Lake and, consequently, the grasses tend to be short. The canopy cover of the herb-dwarf shrub layer is about 70%.

Hilltops and other dry areas near David Lake (Stand 35) are vegetated with species such as *Antennaria nitida* (35% cover), *Artemisia frigida* (20%), *Koeleria cristata* (20%), *Juncus balticus* (15%), *Carex* spp. (10%) and *Poa* species (10%). Important forage species such as *Agropyron trachycaulum*, *Bouteloua gracilis*, *Danthonia intermedia*, *Festuca scabrella* and *Stipa spartea* var. *curtiseta* were not found in this community. The absence of these species coupled with the presence of large stands of *Artemisia frigida* and *Antennaria nitida* may be a reflection of the heavy grazing this area receives.

In depressions, groundwater discharge makes the soil saline (Stand 42). In addition to the common grasslands species, these areas support salt-tolerant species such as *Potentilla anserina* (30% cover), *Distichlis stricta* (15%), *Glaux maritima* (5%), *Hordeum jubatum* (5%), *Puccinellia nuttalliana* (2%), *Salicornia rubra* (1%) and *Suaeda depressa* (1%). Other important species include *Antennaria nitida* (10%), *Poa pratensis* (7%), *Artemisia frigida* (3%), *Cerastium arvense* (3%) and *Deschampsia caespitosa* (3%).

Amid the grassland communities are buckbrush and wolf willow - buckbrush community types. These CTs have well developed low shrub layers (75 - 80% cover) and herb-dwarf shrub layers (50 - 80%). They tend to grow in subxeric and submesic locations where the drainage is good. As in the rest of the grasslands, the soils are Dark Brown Chernozems.

In the wolf willow CT (Stand 33) the cover of the low shrub layer averages 80% and the cover of the herb-dwarf shrub layer 50%. Unlike the buckbrush CT, this CT has a tall shrub layer. Wolf willow, with 40% cover, is the only tall shrub layer species. The low shrub layer consists of buckbrush (70% cover), *Rosa woodsii* (20%) and *Ribes oxycanthoides* (5%).

Important herb species includes *Poa palustris* (25% cover), *Achillea millefoluim* (5%), *Thermopsis rhombifolia* (5%), *Disporum trachycarpum* (2%), *Fragaria virginiana* (2%) and *Galuim boreale* (2%).

In the buckbrush CT (Stands 20 and 32) the cover of the low shrub layer is 77% (75 - 80%). Buckbrush is the dominant shrub (77% cover), but Rosa woodsii (5%) and Prunus virginiana (1%) are also present.

Herb-dwarf shrub cover averages 75% (70% in Stand 20 and 80% in Stand 32). The dominant species common to both stands are Achillea millefolium (13% cover), Koeleria cristata (10%) and Artemisia longifolia (7%). Carex praegracilis (10% cover), Poa palustris (7%), Aster laevis (6%), Agropyron subsecundum (5%), Helicotrichan hookerii (5%) and Stipa spartea var. curtiseta (5%) are common in Stand 32. Important species in Stand 20 are Poa pratensis (8% cover), Poa interior (7%) and Juncus balticus (5%).

No bryoids were found in Stand 20. Brachythecium salebrosum and Peltigera canina were found in Stand 32, but with low cover.

5.3 Aspen Community Types

Stand physiognomy and species composition of aspen stands vary according to their location. Stands with several tree and shrub canopy layers and a high species richness tend to be found at the base of slopes or in mesic depressions. They often ring willow or balsam poplar stands. Poorer stands are found under more xeric conditions and usually support fewer species in fewer layers. Lichens are important in xeric stands.

Dark Brown Chermozems are the dominant soils of aspen stands. Humus usually covers 80 to 90% of the forest floor and exposed mineral soil seldom covers greater than 10% of the forest floor.

Aspen stands growing under xeric conditions are found in interdune depressions, on the sand flats of the undulating plain and on dunes. Stands located in interdune depressions are characterized by a stunted form of aspen which forms a low shrub canopy, a herb-dwarf shrub layer and a well-developed bryoid layer. This CT is discussed earlier under section 5.1 Aeolian Dune Complex.

On the subxeric to submesic sand flats (Stands 13, 24, 25 and 48) aspen communities have a well developed tree canopy of aspen (57.5% cover). The average height of the tree canopy is 6.8 m.

When compared with communities on more mesic sites the low shrub strata of this CT is not well developed. The canopy cover is 22.5% (10 - 40%) and species richness averages 3.5 species per stand with aspen (6.3% cover), Rosa acicularis (5.0%) and Prunus virginiana (3.3%) the dominant species.

The average cover of the herb-dwarf shrub layer is 57.5%. The number of species occurring in this layer varies from 13 to 20 and averages 15.5. Carex foenea (30% cover), Thermopsis rhombifolia (6.5%), Galium boreale (5%), Lathyrus ochroleucus (3%), Smilacina stellata (2%) and

Juniperus horizontalis (1.8%) are the predominant forbs and dwarf shrubs.

Bryoids in these stands have low cover value. Cladonia mitis is the dominant lichen and Pylaisiella polyantha the dominant moss.

The aspen CT of sand flats is heterogenous. The outer edge of these communities is generally next to the more xeric environment of the grasslands and the vegetation near the edge reflects the lack of moisture: aspen trees are often stunted and the herb layer low and sparse.

Closer to the centre of the stand the vegetation becomes denser and more lush. Such a situation may in part be related to the age of the stand; however, an increase in moisture seems to be the critical factor. As the vegetation grows it retains moisture and consequently the humidity within the stand increases. This allows mesophyllic species such as Smilacina stellata and Vicia americana, to establish and also aids in the development of the lush undergrowth typical of Parkland aspen stands.

Aspen stands of sand flats are generally more open than stands on dunes or in mesic locations, therefore, species that are typical of dry and open sites, such as Thermopsis rhombifolia and Carex foenea, are common.

North-facing slopes of dunes support dense aspen stands. The surveyed stands (Stands 29, 46 and 47) are located on slopes averaging 32° and oriented towards the northeast. These dune aspen stands have moisture regimes similar to those on sand flats; however, some dense stands are more mesic.

In these dune stands there is considerable variation in the cover of the tree canopy layer, which comprises only aspen. The cover ranges from 10 to 70% and averages 41.7%. The average height of the tree canopy is 5.7 m.

The cover of the low shrub layer averages 43.3% (30 - 60%). This is almost twice the cover for the same layer in sand flat aspen stands. The dominant species of this layer are Prunus virginiana (18.3% cover), Rosa acicularis (11.7%), Spiraea alba (5.7%), Prunus pensylvanica (5%) and Populus tremuloides (4.3%). Symphoricarpus albus was found in all three stands; however, in two of the stands it occurred in the herb-dwarf shrub layer. The average cover of this species is 16.7%.

The cover of the herb-dwarf shrub layer averages 46.7%, similar to the 57.5% cover for this layer in stands on the sand flats. Carex sp. (6% cover), Galium boreale (5%), Juniperus horizontalis (4.7%), Fragaria virginiana (3.6%), Smilacina stellata (3.3%), Thalictrum venulosum (3.3%) and Maianthemum canadense (2.6%) are the dominant species. Of note is the presence of poison ivy in two stands. Normally poison ivy is found on the south-facing slopes of dune ridges, but it was also found on the edges of aspen stands and in the centre of open aspen stands. The cover of poison ivy averaged 5% in both stands where it occurred.

Bryoids are found infrequently and their canopy cover is usually low (less than 1%).

Aspen communities growing in mesic areas differ from those on xeric sites by the presence of a well-developed shrub canopy I layer. The low shrub canopy layer is more species-rich and has denser cover. The herb-dwarf shrub layer is made up of mesophyllic species only. Only one such aspen stand (Stand 2) was surveyed, but it is typical of mature stands in the study area. Aspen poplar is the only component of tree layer I and in the surveyed stand has an average cover of 40% and an average height of 15 m.

A second tree canopy layer, found only in older stands where a second growth of aspen develops, is often present in rich stands. In Stand 2 this layer has an average cover of 60%. Aspen is the dominant species with 55% cover. Salix sp. (bebbiana?) has 5% cover. The average height of this layer is 6.5 m.

Three shrub species form the herb-dwarf shrub layer (25% cover). This layer comprises Prunus virginiana (15% cover), Amelanchier alnifolia (5%) and Populus tremuloides (5%).

The low shrub layer in Stand 2 comprises eight species and cover averages 85%. Dominant species include Corylus cornuta (25%), Rosa acicularis (25%), Amelanchier alnifolia (15%), Cornus stolonifera (10%) and Rubus strigosus (10%).

The herb-dwarf shrub strata has an average cover of 40%. All important constituents of this stand are mesophyllic and include Symphoricarpus albus (10%), Galuim boreale (10%), Lathyrus ochroleucus (3%), Pyrola asarifolia (3%), Rubus pubescens (3%), Thalictrum venulosum (3%) and Viola rugulosa (3%).

As in other types of aspen stands, bryoids do not make up a significant part of the cover in Stand 2. Five lichen species and two moss species were recorded in the stand and all had a cover of less than 1%.

5.4 Balsam Poplar Community Type

Aside from aspen communities, balsam poplar communities are the only CT in the study area that have a consistently well-developed tree layer. These communities are usually found in more mesic locations than are aspen stands. They are commonly located at the bottom of slopes or in depressions surrounding the more hydrophyllic willow communities.

Two communities were surveyed. Stand 23 is located in the Ribstone Creek valley and Stand 38 is situated on a lower slope north of David Lake. Both are moderately well drained.

Soils under balsam poplar stands are Dark Brown or Black Chernozems which usually show some signs of gleying because of a fluctuating water table. Humus cover is high (85 - 95%) and covers most of the mineral soil.

Balsam poplar is the dominant tree (55 - 65% cover) in the tree layer. Aspen is often a component, but with a lower average cover (15% in Stand 23). In the two surveyed stands the average height of balsam poplar is 17 m.

The understory of balsam poplar stands tends to be moist, humid and have two well-developed shrub canopies. In the tall shrub layer the average cover is about 10 - 15%. Willow and *Viburnum trilobum* are common to both of the surveyed stands while *Prunus virginiana* was found only in the David Lake stand.

The low shrub layer in both stands is dense, lush and species rich; in both stands 11 species make up this shrub layer. Cover averages 60% in the Ribstone Creek stand and 70% in the David Lake stand. *Cornus stolonifera*, *Populus tremuloides*, *Rosa acicularis* and *Symphoricarpos albus* are dominants in both communities. *Ribes americanum*, *Ribes oxyacanthoides*, *Rosa woodsii* and *Salix pseudomonticola* are important in the Ribstone Creek stand and *Corylus cornuta* and *Viburnum edule* in the David Lake stand.

Average cover of the herb-dwarf shrub layer is 72% (70% in Stand 23 and 75% in Stand 38). Species of this strata tend to be mesophyllic to hydrophyllic and are often shade-tolerant. Approximately half the species found in the two balsam poplar communities were not recorded in any of the aspen stands. Twenty-six species were recorded in both stands. *Aralia nudicaulis* (20% cover), *Thalictrum venulosum* (10%), *Rubus pubescens* (8.5%) and *Aster ciliolatus* (5%) are the dominant species common to both communities. Other important species in this strata include *Fragaria virginiana*, *Galium boreale*, *Galium triflorum*, *Geranium richardsonii*, *Smilacina stellata* and *Vicia americana*.

Pylaisiella polyantha (0.5% cover) is the only moss recorded in either stand. No lichens were recorded.

5.5 Willow Community Type

Willow communities occur in areas which have a mesic to subhydric moisture regime and are poorly to imperfectly drained. They are located in mesic or subhygric depressions, or may ring wet meadows, sloughs and fens. In the study area they are also found on raised hummocky sites in fens.

Stands 6, 7, 8, 22, 51 and 59 are willow communities.

The soils are usually gleysols. Humus cover averages 77.5% (60 - 90%) and mineral soil 2.2%. The microtopography of the communities varies from micro-mounded to severely mounded. The latter condition is encountered in some of the willow stands in fens.

Unlike the aspen and balsam poplar communities, standing water was recorded in four of the six willow stands. Water accounts for an average of 4.1% (0.5 - 10%) of the ground cover in the four stands.

Tree layers are not commonly found in willow communities, and when they are present they have a low cover value. A tree canopy of aspen and *Salix planifolia* was found in one stand (cover of 5%).

Average cover of the tall shrub layer is 65% (30 - 85%). Willow species are dominant in most communities; however, in two willow islands located in fens, dwarf birch is co-dominant with willow. The important willow species are *Salix maccalliana*, *Salix myrtillifolia*, *Salix petiolaris* and *Salix planifolia*. *Salix petiolaris* and *Salix planifolia* have the highest frequency of occurrance; they were both recorded in three communities. *Cornus stolonifera* (15% cover) was recorded in one community. Dwarf birch has an average cover of 41.7% (30 - 50%) in the three communities in which it was recorded.

Cover and species composition of the low shrub layer varies considerably. The cover averages 20.2%, but ranges from 0% and 1%, to 70%. In a willow island, where this strata has a cover value of 30%, dwarf birch is the dominant shrub with 25% cover. In a stand adjacent to a fen, *Cornus stolonifera* (17% cover) is the dominant shrub. The cover of the low shrub layer in this stand is 20%. In a willow island, where the cover value of the low shrub layer is 70%, the species composition is diverse. The dominant species are *Symphoricarpos albus* (20% cover), *Ribes americanum* (15%), *Rosa acicularis* (15%), *Ribes oxyacanthoides* (10%) and *Viburnum edule* (10%).

Herb-dwarf shrub growth is usually patchy in willow communities. Where the shrub canopy is dense, the forest floor is shaded and consequently the herb-dwarf shrub layer is sparse. In areas where the canopy thins and sunlight is admitted, growth is often dense and lush. Species frequently occurring in willow stands include *Pyrola asarifolia* (5 stands), *Rubus pubescens* (5), *Epilobium angustifolium* (4), *Galium triflorum* (4), *Carex rostrata* (3), *Fragaria virginiana* (3), *Geum allepicum* (3) and *Viola rugulosa* (3). Three orchid species, each in a different stand, were recorded: *Corralorhiza trifida*, *Habenaria hyperborea* and *Habenaria viridis* var. *bracteata*.

Bryoid cover is important in some willow stands. In the surveyed communities cover averages 13.3% (0 to 30%). Lichens are generally found on deadfall and woody plants, so a systematic survey of the species present was not conducted. Twelve bryophyte species were recorded. *Plagiomnium ellipticum* (5.3%) and *Aulocomniun palustre* (2.3%), both found in three stands, are the most frequent. Other important mosses include *Helodium blandowii* and *Tomenthypnum nitens*.

5.6 Wet Meadow and Shoreline Communities

Wetland vegetation was not broken into distinct community types due to the complexity and diversity of the vegetation patterns.

5.6.1 Wet Meadows

The species composition of wet meadows is variable. Although all of the stands are poorly drained and have a hygric or subhydric moisture regime, other factors such as grazing pressure, soil type and the fluctuation of the water level influence species composition and species abundance.

Four wet meadows (Stands 19, 34, 43 and 45) were surveyed. Two of them are located on the north shore of David Lake and two in depressions. Water cover averages 18.8%, but varies from 0% in one stand to 40% in another.

Average cover of the herb-dwarf shrub layer is 87.5% (70 - 95%). Species that frequently occur with high cover values include *Calamagrostis inexpansa*, *Juncus balticus*, *Poa pratensis* and *Potentilla anserina*. Several sedges are important constituents. These include *Carex aquatilis*, *Carex lasiocarpa*, *Carex rostrata* and *Carex sartwellii*. *Glyceria striata*, *Hordeum jubatum*, *Mentha arvensis* and *Polygonum amphibium* occur with high frequency but low cover. *Scirpus acutus*, an emergent, was recorded in two stands.

A low shrub canopy is present in some stands but a cover value greater than 5% was not recorded. The presence or absence of shrubs depends on the water conditions. During high water conditions the shrubs, usually willows, drown, when the water levels drop they invade again. Balsam poplar, aspen, *Rosa acicularis*, *Salix bebbiana*, *Salix candida*, *Salix petiolaris* and *Salix planifolia* occasionally grow in wet meadows, but with low cover.

Drepanocladus sp. was recorded in one stand. No other bryoids were observed.

5.6.2 Shoreline and Drawdown Zone

Drawdown zones (the shoreline area over which waterbodies periodically fluctuate) support many of the same species as wet meadows (Stand 44); however, there are differences in species composition and abundance. The most significant difference is the presence and abundance of salt-tolerant species in the drawdown zone such as *Glaux maritima*, *Puccinellia nuttalliana*, *Salicornia rubra*, *Scirpus americanus* and *Senecio congestus*. The former two species were also recorded in a wet meadow stand, but with much lower cover. *Hordeum jubatum*, *Juncus balticus*, *Potentilla anserina* and *Ranunculus cymbalaria* are salt- and drought-tolerant species that are common to both wet meadows and drawdown zones and have high cover values in drawdown zones.

No bryoids were recorded.

5.6.3 Wallaby Lake and David Lake

The uplands surrounding Wallaby Lake are vegetated with aspen poplar forest (Stand 18). The sandy shoreline and lake bottom support a variety of plant species (Stand 10). As is commonly found in lakes with sand substrates, emergent growth is limited. Small stands of *Eleocharis palustris*, *Scirpus acutus*, *Scirpus validus* and *Typha latifolia* are scattered around the lake.

The drawdown zone comprises sites that are often but not permanently flooded. The important species in this zone are *Alopecurus aequalis*, *Carex lasiocarpa*, *Carex rostrata*, *Glyceria striata*, *Poa palustris*, *Puccinellia nuttalliana* and *Scirpus americanus*. *Calamagrostis inexpansa*, *Juncus balticus*, *Poa pratensis*, *Potentilla anserina* and *Ranunculus cymbalaria* also occur.

Several herbs occur on the moist uplands adjacent to and within the upper portion of the drawdown zone. They include *Antennaria nitida*, *Aster laevis*, *Aster pansus*, *Cirsium arvense*, *Elymus canadensis*, *Fragaria virginiana*, *Lobelia kalmii*, *Mentha arvensis*, *Primula incana*, *Prunella vulgaris*, *Senecio pauperculus* and *Taraxacum officinale*.

Hypnum cupressiforme and *Pohlia nutans* are important moss species on the Wallably Lake shoreline. No other bryoids were recorded.

The low shrub layer is well developed (20% cover). *Salix planifolia* is the dominant species followed by *Salix petiolaris*, *Salix candida*, *Betula papyrifera* and *Salix bebbiana*.

The shoreline vegetation of David Lake is described under sections 5.6.1 Wet Meadows and 5.6.2 Shoreline and Drawdown Zone. *Scirpus acutus* is the dominant emergent in the lake. It forms a wide band around most of the lake and being well interspersed with open water it provides excellent escape, nesting and brood cover for marsh birds.

5.6.4 Beaver Ponds

At least seven beaver ponds are present in the interdune fen complex. The uplands surrounding the beaver ponds are usually aspen or balsam poplar forest with a dense shrub layer of *Cornus stolonifera*, *Prunus virginiana*, *Ribes americanum*, *Ribes oxyacanthoides*, *Rosa acicularis*, *Rubus strigosus*, *Salix* spp. and *Sheperdia canadensis*.

Immediately adjacent to the water are stands of *Populus balsamifera*, *Salix bebbiana*, *Salix petiolaris*, *Salix planifolia* and *Salix serissima*. Growing on the moist shaded ground are species such as *Equisetum arvense*, *Fragaria virginiana*, *Lysimachia ciliata*, *Polygonum* spp., *Pyrola asarifolia*, *Rubus pubescens* and *Sium suave*.

Herb species associated with beaver ponds in the study area are similar to those found in wet meadows or freshwater sloughs. Emergent species include *Scirpus acutus*, *Scirpus validus* and *Typha latifolia*. Other hydrophyllic species common to most freshwater areas are *Alopecurus aequalis*, *Calamagrostis inexpansa*, *Carex rostrata*, *Eleocharis palustris*, *Equisetum fluviatile*, *Glyceria grandis*, *Glyceria striata*, *Juncus balticus*, *Poa palustris*, *Potentilla anserina* and *Sium suave*.

Several species were found to be associated with the hygric and often organic and shaded conditions of the ponds. Grass and *Carex* species include *Calamagrostis canadensis*, *Glyceria borealis*, *Phalaris arundinacea*, *Carex canescens*, *Carex crawfordii*, *Carex diandra* and *Carex interior*. Herbs recorded include *Agrimonia striata*, *Bidens cernua*, *Cicuta bulbifera*, *Epilobium glandulosum*, *Galium trifidum*, *Galium triflorum*, *Lysimachia ciliata*, *Lysimachia thrysiflora*, *Scirpus microcarpus*, *Scutellaria galericulata*, *Urtica gracilis* and *Veronica americana*.

5.7 Fens

The fens located in the study area are unusually extensive for the Parkland and are the southern-most fens in eastern Alberta. Water movement through the study area is from the northwest to southeast, primarily through groundwater flow. The slow moving groundwater picks up nutrients from the soil and fulfills the nutrient requirements necessary for fen development. Most of the fens are interdunal and associated with beaver ponds.

Fens occupy approximately 125 ha (or 2.5%) of the study area. They range in size from the sloping fen at about 1 ha to one at about 75 ha. Average size is 16 ha. Stands 5, 9, 21, 39, and 53 to 58 are located in fens.

Fens in the study area are characterized by hummocky peatland and by a well-developed low shrub layer of dwarf birch and willows. Patterning, the alternating of raised ridges or strings with water-filled depressions or flarks, is fairly well-developed in two of the larger fens northwest of David Lake. In many, the occurrence of areas of particularly high hummocks enables islands of willow stands to develop that are more typical of upland areas.

Two fens differ from the typical ones found in the study area. North of David Lake groundwater flowing down a hillside has resulted in the development of a sloping fen. A fen is present on the east side of

Ribstone Creek one where the creek valley overlaps the study area boundary. This is unusual because the water and nutrient source is an open and flowing creek; the fen itself forms the east bank of the creek.

The moisture regime ranges from hygric to hydric. Standing water was found in all but one.

The soils are Organic Fibric Mesisols. The depth of the soil was not determined; however, where a cursory examination was made, the organic material was found to be 0.5 m deep in one fen and more than a metre deep in another.

Based on the acidity of the ground water and on the species composition, all fens in the study area are fairly rich minerotrophically and should be described as transitional rich fens (Sjors 1950 in Slack *et al.* 1980). Acidity readings were not taken for the Ribstone Creek fen but the ones that were tested had a mean pH value of 6.8 (6.6 - 7.1). These values compare favourably to the pH readings of rich fens located in the foothills of Alberta (Slack *et al.* 1980). Of the nine fens studied by Slack *et al.* (1980), four had mean pH values between 6.8 and 7.1. The acidity of the other five ranged from pH 7.2 to a high of 7.9. In contrast, fens in the Swan Hills, that were described as poor fens, have mean pH values of 5.2 (Vitt *et al.* 1975).

Sjors (1950 and 1963 in Vitt *et al.* 1975 and Slack *et al.* 1980) listed vascular and non-vascular plants considered indicative of rich fen conditions, several of which are present in the Wainwright fens. *Triglochin maritima* is considered indicative of extremely rich conditions; it was recorded in all but one of the fens in the study area, with cover values ranging from 0.1% to 7%. *Habenaria hyperborea* and *Tofieldia glutinosa*, indicators of similar conditions, are present in most fens in the study area. Other vascular plants present that are rich fen indicators include *Carex capillaris*, *Carex limosa*, *Drosera anglica*, *Equisetum fluviatile* (with high frequency), *Menyanthes trifoliata* (with high frequency), *Parnassia palustris*, *Potentilla palustris*, *Salix* spp. and *Utricularia intermedia*.

The bryophytes *Bryum pseudotriquetrum*, *Campylium stellatum*, *Drepanocladus revolvens*, *Sphagnum warnstorfii* and *Tomenthypnum nitens* are indicators of minerotrophically rich fens and occur within the Wainwright fens. In contrast to poor fens in the Swan Hills where *Sphagnum* is usually the dominant string species (Vitt *et al.* 1975), *Tomenthypnum nitens* dominates the string vegetation in the study area. *Sphagnum* is uncommon and confined to hummocks. Similarily, Slack *et al.* (1980) found *Tomenthypnum nitens* to be the dominant bryophyte on strings in the rich fens of the foothills and *Sphagnum* uncommon.

Floristically, all the fens in the study area are similar, with slight differences in species composition and abundance related to moisture regime.

The low shrub layer is well-developed . Most shrubs are confined to hummocks and strings, but dwarf birch is also found in flarks, albeit with lower cover. On strings the average cover of the low shrub layer is 65% (60 to 70%) while in flarks it is 9% (2 to 20%).

Dwarf birch is the dominant shrub and has a relatively high cover value in all the fens in the study area. In one it forms a tall shrub layer. In flarks its cover averages 9%, and on strings 55%. Moisture conditions play an important role in determining its growth form. In very wet flarks this shrub seldom averages much more than 0.5 m in height while on drier sites it averages 2.5 m.

Salix candida occurs in all the fens, but with less cover than dwarf birch. It usually grows on hummocks and strings with a canopy cover of 6.6%.

Relatively dry fens also support *Cornus stolonifera*, *Salix pedicillaris*, *Salix petiolaris*, *Salix planifolia* and *Salix pseudomonticola*. They have cover values comparable to those of *Salix candida*.

The absence of coniferous trees such as tamarack and black spruce makes the fens in the study area distinct from those described by Vitt *et al*. (1975), Slack *et al*. (1980) and Lee *et al*. (1982).

Carex diandra, *Carex limosa*, *Equisetum fluviatile*, *Menyanthes trifoliata* and *Triglochin maritima* are the dominant flark species. Other herb species found in flarks include *Carex aquatilis*, *Carex lasiocarpa* and *Eriophorum viridi-carinatum*. *Drosera anglica* and *Utricularia intermedia* are present in flarks but with lower cover. Dwarf shrubs present are *Betula pumila*, *Salix candida*, *Salix pedicillaris* and *Salix serissima*. *Drepanocladus* spp. (including *D. aduncus*, *D. examulatus* and *D. revolvens*) are the dominant bryophytes. They form a moss substrate along with lesser amounts of *Brachythecium turgidum*, *Calliergon stellatum*, and *Meesia triquetra*. The flark vegetation described above is similar to vegetation described in flarks of western Alberta (Slack *et al*. 1980).

Strings 0.5 to 1 m higher than the level of the flarks are characterized by a dense cover of dwarf birch (55% cover) and the presence of *Salix candida*. Important herbs include *Carex aquatilis*, *Carex interior*, *Carex rostrata*, *Menyanthes trifoliata*, *Phleum pratense* and *Potentilla palustris*. The dominant bryophyte is *Tomenthypnum nitens*. Lesser amounts of *Aulocomnium palustre*, *Drepanocladus* spp. and *Meesia triquetra* also occur on strings. Apart from the absence of tamarack these strings are similar to those described by Slack *et al*. (1980).

The mesic environment of hummock tops and some strings support many species characteristic of fens. Bryophytes include *Dicranum undulatum*, *Helodium blandowii*, *Plagiomnium ellipticum*, *Sphagnum squarrosum* and *Sphagnum warnstorfii*. Vascular species include *Aster junciformis*, *Eriophorum angustifloium*, *Lilium philadelphicum*, *Lobelia kalmii*, *Parnassia palustris*, *Pedicularis groenlandica*, *Pinguicula vulgaris*, *Prunella vulgaris*, *Tofieldia glutinosa*, *Viola nephrophila* and *Zygadenus elegans*.

Upland plants such as Aster ciliolatus, Fragaria virginiana, Galium boreale, Pyrola asarifolia, Rubus pubescens, Stellaria longipes and Zizia aptera are found on the driest hummocks.

Orchids found on the moist hummocks include Corralorhiza trifida, Cypripedium calceolus, Habenaria dilatata and Habenaria hyperborea.

5.8 Aquatic Vegetation

Twenty submergent or floating plant species occur in the waterbodies of the study area. Beaver ponds have the richest flora. Six Potamogeton species occur in the ponds, including Potamogeton friesii, Potamogeton gramineus, Potamogeton pusillus, Potamogeton richardsonii, Potamogeton vaginatus and Potamogeton zosteriformis. Other submergents include Ceratophyllum demersum, Myriophyllum exalbescens and Utricularia vulgaris.

Hippuris vulgaris, Lemna minor, Lemna trisulca, Ranunculus circinatus, Ranunculus gmelini, Sagittaria cuneata, Sparganium chlorocarpum and Sparganium minimum are floating species found in the beaver ponds.

Potamogeton richardsonii and Potamogeton vaginatus are found in Wallaby Lake.

Potamogeton filiformis, Potamogeton vaginatus and Ruppia occidentalis were recorded in David Lake.

Utricularia intermedia occurs in the small shallow pools or on the wet peat of the fens.

5.9 Area of Vegetation Types

Based upon measurements of transects on 1982 black and white aerial photographs (1 : 30 000), poplar forest constitutes 41% of the study area. Fourteen per cent of the site is grassland. Scrubland, which refers to the stunted aspen and the grasslands interspersed among it, accounts for 28% of the area. The fens, or muskeg as they are referred to in the early survey reports, constitute 6% of the study area. (When the fens in the study area were measured with a planimeter it was determined that fens account for 125 ha or 2.5% of the site.) Willow, wet meadows and water make up 2%, 3% and 6% of the site respectively. Table 2 lists the area of each vegetation type in the study area.

TABLE 2

AREA IN PER CENT OCCUPIED BY EACH VEGETATION TYPE IN 1903-1904 AND 1982.

Vegetation type	Year 1903-1904[1]	1982[2]	Difference: 1903-1904 and 1982
Grassland	27.3	14.0	-13.3
Poplar	17.7	41.0	+23.3
Scrubland	35.0	28.0	-7.0
Willow	5.4	2.0	-3.4
Wetlands	10.3	9.0	-1.3
Fens	4.3	6.0	+2.3

[1] From transects of Dominion of Canada legal land survey (Fairchild 1903 and Fawcett 1904).

[2] From transects on 1982 black and white aerial photographs.

5.10 Brush Invasion of Grassland

Bailey and Wroe (1974) measured brush cover along randomly-selected transects from 1907 Dominion of Canada legal land survey field notes and compared them to the same transects on 1966 aerial photographs. All transects were within Township 34, Range 19 and West of the Fourth Meridian. They found aspen cover increased 3.2% during the 59-year period from 1907 to 1966, or 0.05% annually.

A similar study undertaken in the Rumsey Candidate Ecological Reserve compared transects in 1907 to the same transects in 1979 (Fehr 1982). Aspen increased 15% during the 72-year period. There was a concurrent 15% decrease in the area of grassland; it dropped from a total cover of 88% to 73%. The annual rate of aspen invasion was 0.21%.

In the Wainwright study area, the transects from the Dominion Land Survey that lay within the site were compared to the same transects on 1982 aerial photographs. Comparisons of 1903 - 1904 and 1982 were difficult because the terminology used by the early surveyors to describe the vegetation was inconsistent and consequently, an interpretation of the terms had to be made in order to classify the vegetation. Table 2 lists changes in area of each vegetation type between 1903 - 1904 and 1982.

Poplar cover in the study area increased 23.3% to a total of 41.0%. The area of grassland decreased 13.3%, from 27.3% to 14.0%. Scrub poplar decreased by 7%. This decrease may be accounted for by the increase of poplar forest, because as the scrub poplar expanded they may have developed into typical poplar stands and then recorded as such on the 1982 photographs. Changes in buckbrush and wolf willow cover were not determined as these stands were included within the grassland vegetation type.

The encroachment of aspen into the grasslands was originally thought to be related to the supression of fires by settlers and to the extermination of bison in the late 1800s. It appears, however, that moist and cool climatic conditions prevailed in the early 1800s and allowed aspen groves to expand. Moss (1932) found aspen stands estimated to have been established in 1818 - before bison vanished or settlers appeared. In a study in Minnesota, U.S.A., Buell and Cantlon (1951) concluded that the rapid expansion of maple-basswood stands after 1810 was due to climatic change. In Montana, U.S.A., Lynch (1955) reported that the grassland-forest ecotone was stable, due primarily to the distribution of precipitation and secondarily to biotic factors. Fires were uncommon and deemed unimportant in maintaining the grassland. The cause of aspen expansion into grassland is an important question that requires further investigation.

6. FAUNA

The Wainwright study area encompasses a variety of wildlife habitats: wetlands, fens, shrubland, aspen and balsam poplar groves, grassland and dune complexes. The study area and the Canadian Forces Base Wainwright to the north provide a large, relatively natural block of habitat for wildlife. Ongoing habitat destruction in the Aspen Parkland makes this site increasingly important for the protection of wildlife and plant species. The presence of an extensive sand dune and fen complex is unusual in the Aspen Parkland and is suitable habitat for many wildlife species usually not found this far south in eastern Alberta.

Selected wildlife sightings are presented in Figure 3.

6.1 Birds

Ninety-six bird species were identified in the study area during the spring and summer of 1983. Bradley and Bradley (1977) reported an additional 26 species. Appendix 8 is an annotated list of the birds reported for the area.

Waterbodies and associated wetland communities are rich in bird life. Large numbers of waterfowl (300 to 600 birds) were often observed on Wallaby Lake and David Lake. Commonly observed waterfowl species include blue-winged teal, lesser scaup and mallard. Less commonly seen species include American wigeon, bufflehead, canvasback, gadwall, green-winged teal, northern shoveler and redhead. Ruddy ducks and white-winged scoters were seen on Wallaby Lake only and northern pintails were seen on David Lake only. Two pairs of Canada geese, each with five young, were seen on David Lake. No geese were observed on Wallaby Lake.

On the beaver ponds throughout the study area blue-winged teal, green-winged teal, mallard, northern pintail and wigeon were observed. Bufflehead and lesser scaup were the only diving ducks observed on the ponds. Canada geese were occasionally sighted.

Several grebe species are associated with the wetlands in the study area. Red-necked grebes were observed on Wallaby Lake and on the large beaver pond. A colony of eared grebes was located on the southwest shore of David Lake and horned grebes were found on both lakes and on several beaver ponds.

Shorebird species observed frequently were killdeer, common snipe, spotted sandpiper, lesser yellowlegs, willet, marbled godwit, American avocet and Wilson's phalarope.

Figure 3. Selected Wildlife Sightings (May-July 1983)

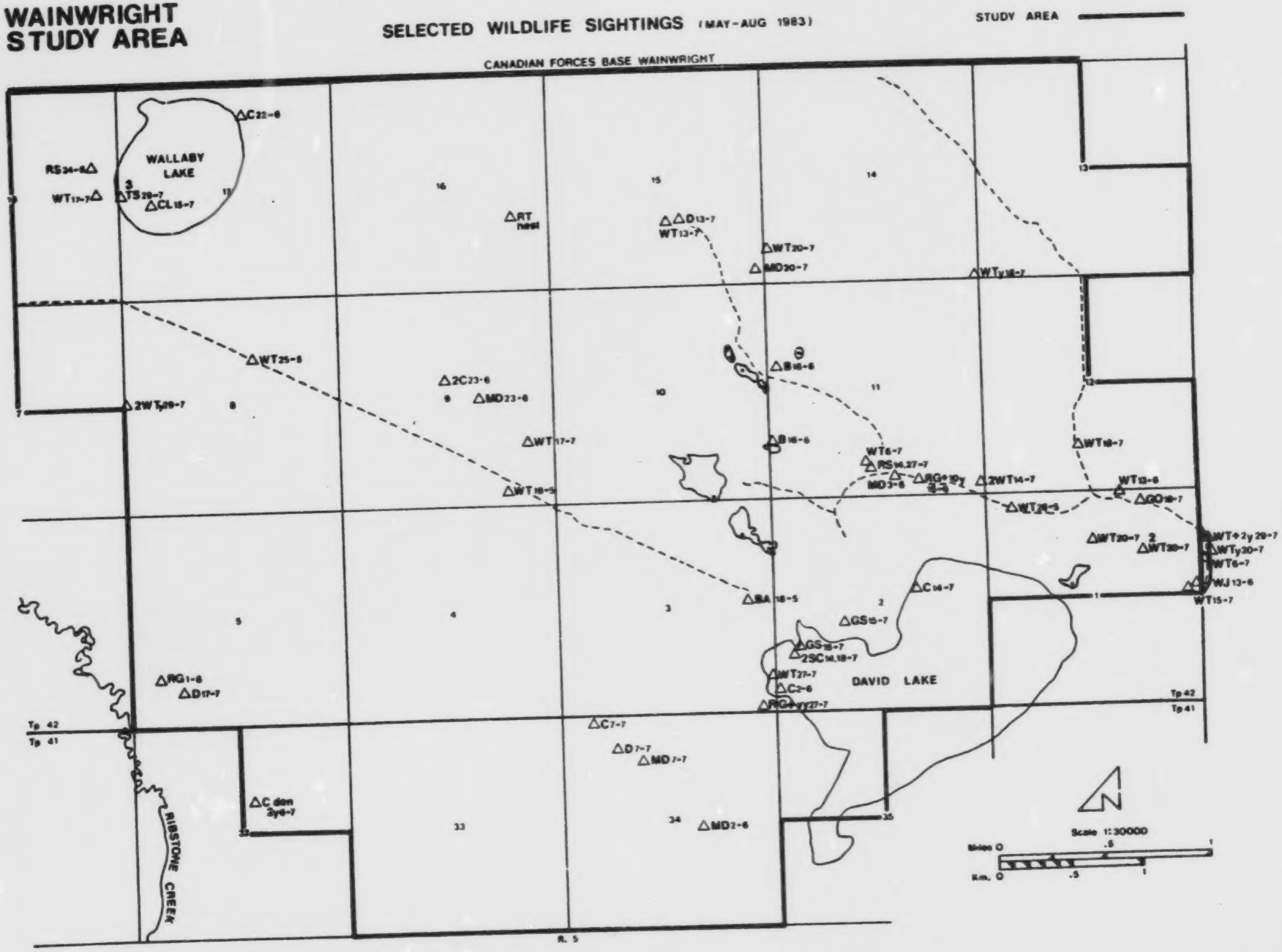
LEGEND

TS	Tiger salamander (larvae)
GS	Plains garter snake
CL	Common loon
RT	Red-tailed hawk
	Ruffed grouse
RG	Sandhill crane
GO	Great horned owl
WJ	White-tailed jack rabbit
B	Beaver
•	Beaver lodge
RS	Red squirrel
C	Coyote
BA	Badger
MD	Mule deer
WT	White-tailed deer
y	Young
- - -	Vehicle trail
◯	Ponds
12-7	Observation data (day-month)

FIGURE 3

WAINWRIGHT STUDY AREA

SELECTED WILDLIFE SIGHTINGS (MAY-AUG 1983)


STUDY AREA
CANADIAN FORCES BASE WAINWRIGHT
WALLABY LAKE
RS24-6
WT17-7
3
TS29-7
CL15-7
C22-6
16
RT nest
15
D13-7
WT13-7
14
WT20-7
MD20-7
WTy18-7
13
WT25-6
2WTy29-7
8
2C23-6
9
MD23-6
10
B16-6
11
12
WT17-7
B16-6
WT6-7
RS14,27-7
MD3-6
RG+10y 2-7
2WT14-7
WT18-7
WT13-6
GO18-7
WT18-5
WT29-5
WT20-7
2
WT20-7
WT+2y 29-7
WTy20-7
WT6-7
WJ 13-6
WT15-7
1
BA 18-5
C14-7
2
GS15-7
GS18-7
2SC14,18-7
WT27-7
C2-6
RG+yy27-7
DAVID LAKE
3
4
5
RG1-6
D17-7
Tp 42
Tp 41
C7-7
D7-7
MD7-7
C den 3y6-7
32
33
34
MD2-6
35
RIBSTONE CREEK
R. 5
N
Scale 1:30000
Miles 0
.5
1
Km. 0
.5
1

Other wetland bird species observed include northern harrier, American coot, California gull, ring-billed gull, Franklin's gull, marsh wren, common yellowthroat, yellow-headed blackbird, red-winged blackbird, Le Conte's sparrow and sharp-tailed sparrow.

Of special interest are the sightings of sandhill cranes in the area. Although the study area is within the former breeding range of this species, there have been no recent authenticated breeding records for this region. On two occasions two cranes were seen foraging along the northwest shore of David Lake. They had the bare red forehead indicative of mature birds, but the plumage was the rusty brown color of immatures. They may have been a young non-breeding pair that had not yet established a breeding territory. Crane calls were heard throughout the summer of 1983 so it is believed that the pair (or pairs) was resident.

One pair of cranes with two young were sighted in a grain field 3 km south of David Lake in the spring of 1983 by a farmer from the area (Maull, pers. comm.). Suitable nesting sites are present in the fens in the study area and in marshes surrounding lakes in the region, so the return of a breeding population of sandhill cranes to the region is possible if the fens remain intact and isolated.

The woodlands in the study area offer a variety of habitats. Observed in low-lying shrub stands of willow and birch were alder flycatcher, least flycatcher, cedar waxwing, and warbling vireo. The mature lush balsam and aspen stands with their thick understory of shrubs support American redstart, hairy woodpecker, northern oriole, ovenbird and veery. Species found in aspen stands throughout the site include black-capped chickadee, chipping sparrow, red-eyed vireo, white-throated sparrow, ruffed grouse, great-horned owl, Cooper's hawk, blue jay, mourning dove, American robin and dark-eyed junco.

Savannah sparrow, vesper sparrow, clay-colored sparrow, western meadowlark, upland sandpiper and Say's phoebe are grassland species; however, the former three species were usually found in close association with shrubs. Horned larks were seen foraging in the two cultivated fields within the study area. Mountain bluebird, eastern kingbird, western kingbird and lark sparrow occupy the ecotonal area between aspen stands and grasslands. Droppings from sharp-tailed grouse were commonly seen in the grasslands and buckbrush patches, but no birds were observed.

Common nighthawks forage throughout the study area, but are most commonly observed in the dune complex.

Red-tailed hawk, broad-winged hawk, common crow and black-billed magpie are found throughout the study area.

Bradley and Bradley (1977) identified several species of birds that reach the southern limit of their range in eastern Alberta in the Wainwright region. These include species such as Tennessee warbler, ovenbird, American redstart, rose-breasted grosbeak, Lincoln's sparrow, sharp-tailed sparrow, white-throated sparrow and yellow-bellied sapsucker.

6.2 Mammals

A systematic survey of the mammals in the study area was not conducted; however, Salt (1977) used field observations and museum specimens to compile a report on the mammals in the Wainwright Sandhills - Ribstone Creek region. Although Salt's study included areas outside the study area, the species list he compiled is probably an accurate reflection of the mammals found within it.

A total of 31 species have been observed or collected in the region of the study area. Fifteen species were observed by the author during the study and Salt (1977) lists an additional 16 species that he either observed, collected or determined from museum collections. A further 14 species are expected to occur in the region (Banfield 1974); however, some of the species may be transients (e.g. lynx) or migrants (e.g. some bat species). Appendix 9 is an annotated list of species that are either known or expected to occur in the study area.

Historically the region supported bison, wapiti, grizzly bears, wolves and prairie dogs, but according to Farley (1925), they had all disappeared by the late 1800's.

Salt (1977) concludes from his study that a large number of mammalian species are found in the region, but that the individual populations are small. He feels the populations are relatively fragile and susceptible to increased agricultural development. Wetlands are especially important because they provide valuable winter habitat. He believes the area should be left to serve as a breeding refugium for wildlife in the region.

Four species of shrews have been collected and a fifth species is expected to occur. No bats have been recorded, but up to seven species are expected to occur in the study area at various times during the year.

Two lagomorphs are known to occur in the study area. Snowshoe hares were not observed by the author, but this may be due to the cyclical nature of their populations. White-tailed jack rabbits observed on the edge of the study area are probably close to the northern limit of their range. If the presence of Nuttall's cottontail in the region is confirmed (bone fragments of this species were found in a raptor pellet by Salt) it would be a northern extension of its range.

Eighteen rodents are either known or expected to occur in the study area. Nine species were seen by the author and an additional four species were confirmed by Salt (1977). Small mammal trapping could yield some interesting information as little is known about the small mammals in the region.

Beaver are important inhabitants of the study area. The beaver ponds are associated with the fens and they provide a variety of mesic, wet and aquatic habitats for plant and animal species.

Coyotes and badgers were the only carnivores observed by the author. Dens of both species were found in the study area, usually in the sand dune area. There is a breeding population of coyotes as two pups were seen at a den site. One red fox was sighted 4 km south of the study area so there is likely a fox population that uses the area for foraging and possibly for breeding. A local rancher in the area (Maull 1983, pers. comm.) has observed an increase in the fox population over the past 10 years.

A relatively large deer population lives in the study area. Both mule deer and white-tailed deer were observed; however, only 17% of the observations were of mule deer (five out of 30 deer sightings). No mule deer fawns and four white-tailed deer fawns were observed.

There is a small transient population of non-breeding moose in the study area. Fresh tracks and droppings were found, but no moose were seen.

6.3 Reptiles and Amphibians

One reptile and four amphibian species were found in the study area (Appendix 10). The most commonly observed species were Canadian toads (Bufo americanus hemiophrys) and wood frogs (Rana sylvatica). The former species inhabits moist woods, shorelines and fens, and the latter is found in moist woods and grasslands. Boreal chorus frogs (Pseudacris triseriata maculata) are found most often in standing water. Tiger salamanders (Ambystoma tigrinum) were found only in their larval stage in Wallaby Lake, but they are probably more common than indicated by the number of observations. The only reptile species recorded was the plains garter snake (Thamnophis radix).

There is record of a western hognose snake (Heterodon nasicus) having been collected in the town of Wainwright by Frank Goddard (Roberts 1983, pers. comm.). If the collection is confirmed, this could indicate a considerable range extension northwards.

7. DISTURBED SITES

Most land disturbances are a result of ranching operations and oil and gas industry activities. Figure 4 shows the location of disturbed sites.

Bison and most other large ungulates disappeared from the area by about 1890 (Farley 1925). The range was probably in good condition at least until the turn of the century when domestic livestock was brought in.

Presently the east range (BP4) is grazed by cattle part of June and from July to the end of October. Carrying capacity of BP4 is 1 400 AUM (animal unit months). The David Lake area is grazed in June, July and August and the dune region is grazed in September. The cattle are moved to the east side of BP4 for the month of October. The west range (BP5) has not been grazed for five years. Grazing at a rate of 1 200 AUM per year will be allowed on this range in the future. A more detailed explanation of the grazing system is given under section 2.6 History and Land Use.

The areas most heavily affected by grazing are the meadows around David Lake and the grasslands to the north and west of the lake. Wet meadows and the shores of some ponds and fens are also heavily grazed. Grazing in the dune region does not appear to be heavy, probably because there are few watering sites.

In 1979 Alberta Public Lands Division evaluated ranges BP4 and BP5 as in fair (poor to good) condition. A range management plan was designed that would improve cattle distribution and thus range condition. To institute the range management plan several changes in the range were made, most of them within the last five years. Most of the disturbances in the study area are associated with the institution of the management plan.

The range improvement that is probably most permanent and detrimental to the natural habitats was the breaking and seeding of two 16 ha growth trial plots (Sections 5 and 8) in the grassland of BP5. The ground was cultivated in the fall of 1982 and seeded with five grass species and two legumes in 1983. The following plants were seeded: alfalfa, sweet clover, oats (Avena sativa), Altai wild rye (Elymus angustus), Regar meadow brome (Bromus biebersteinii), Nordan crested wheat grass (Agropyron desertorum) and pubescent wheat grass (Agropyron trichophorum). This was an experimental planting to determine which species would be suitable for future regrassing in the Wainwright Sandhills region. At the end of July both fields were well vegetated with seeded and native plants; however, areas on the hilltops and hillsides were very sparse compared with lower areas.

Figure 4. Disturbed Sites

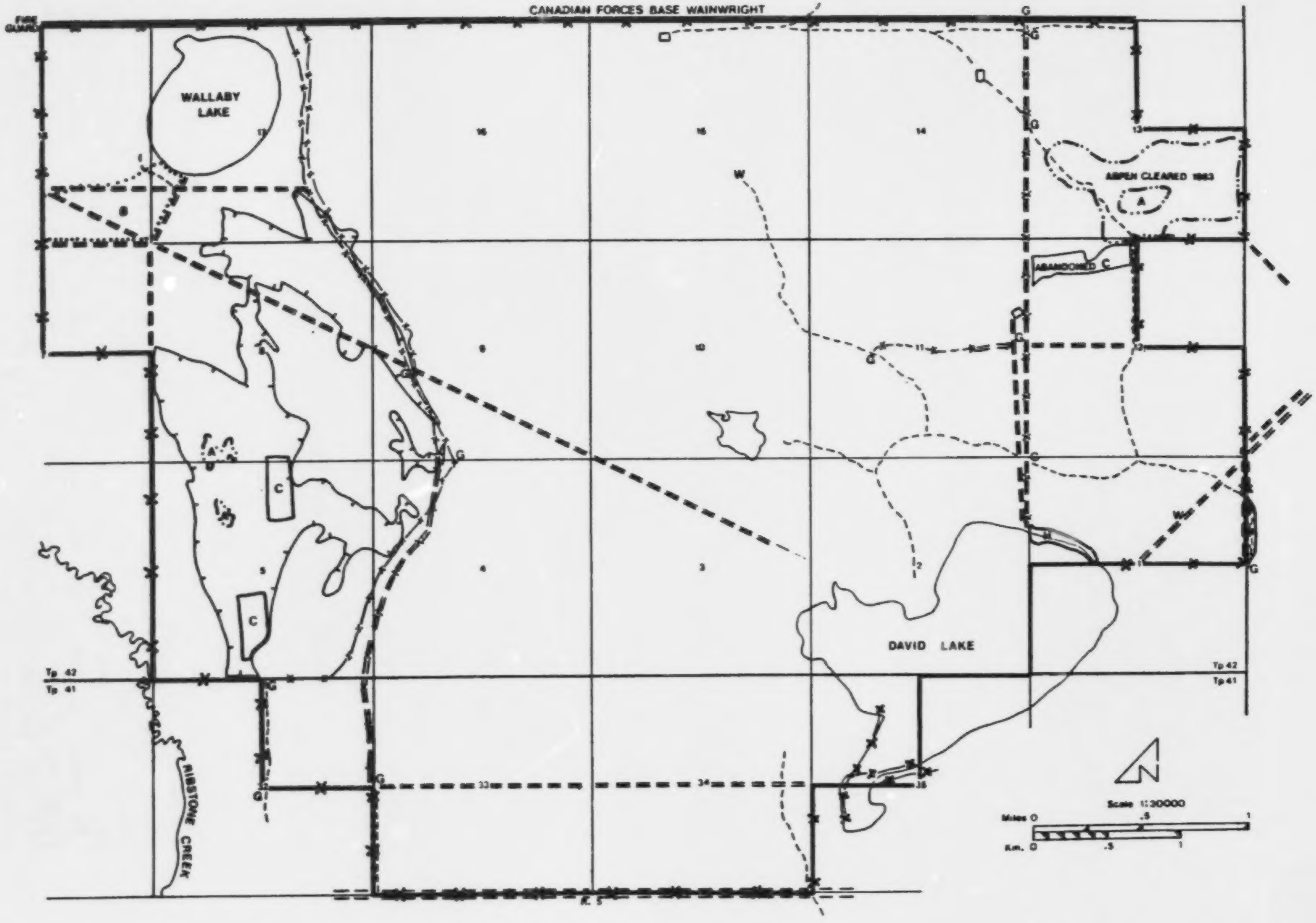
LEGEND

- - - - - - -	vehicle trails
= = = = =	cutlines
—x—x—x—x—	fencelines
G	gates
W	gas well sites
☐	dugouts
H	hayed area
B	burned area (spring 1983)
	spiked grassland (1971-1972)
C	cultivated and seeded grassland (1982-1983)
A	aspen poplar stands

FIGURE 4

WAINWRIGHT STUDY AREA

DISTURBED SITES


STUDY AREA
CANADIAN FORCES BASE WAINWRIGHT
FIRE GUARD
WALLABY LAKE
ASPEN CLEARED 1983
A
ABANDONED C
C
C
DAVID LAKE
RIBSTONE CREEK
Tp 42
Tp 41
17
16
15
14
13
8
9
10
11
12
5
4
3
2
33
34
35
G
W
Scale 1:20000
Miles 0 .5 1
Km. 0 .5 1

In the early 1970s much of the grassland in BP5 was spike cultivated in strips and several species planted. Only smooth brome (Bromus inermis) and alfalfa have established; alfalfa has persisted in only a few small areas. Since little sod was turned over and only smooth brome has persisted, the effects of spiking are not very noticeable. In comparison with pristine native grassland (Stand 11), the disturbed grassland (Stand 12) has less humus cover, less herb-dwarf shrub cover and greater cover values of increaser species such as Artemisia frigida. (These two stands are discussed in section 5.2 Grasslands.) If left undisturbed, this grassland will probably return to its native state.

A cultivated field in Section 12 was abandoned during the homesteading era and has now reverted to mostly native grassland species.

About 32 ha of aspen southwest of Wallaby Lake were burned in the spring of 1983. The fire killed a few patches of aspen and shrubs, removed some of the underbrush and scorched many of the aspen trees. This burn will probably have no long-term impact.

Approximately 65 ha of aspen were mechanically cleared in Section 13 in 1983. More clearing (115 ha) will be undertaken during the winter of 1983 and 1984. Clearing is not a natural process but has little long-term impact on the area as aspen grows back rapidly. Removal of some aspen forest by either burning or clearing may actually benefit many wildlife species. However, further brushing of the cleared areas, with the use of chemicals or fire, and subsequent breaking and seeding would probably remove the native vegetation permanently.

A cutline 250 m long and between 21 and 37 m wide was cut in a grassland area through aspen forest to Wallaby Lake to provide better access to the lake for cattle.

In the late 1940s, the study area was fenced for the first time. The perimeter of the site is fenced and a fence divides ranges BP4 and BP5. To institute a rotational grazing system three cross fences were built in range BP4. A fourth fence is planned for BP4. (See 2.6 History and Land Use for more details.) As well, a new fence was built between ranges BP4 and BP5. The cutlines for the new fences are 20 to 32 m wide, but they will probably grow back. The impact that fences have on a natural area is probably limited to philosophical questions regarding quality.

Three dugouts have been constructed in the study area to improve livestock distribution. The effect these dugouts have on preventing or causing vegetative damage was not studied. They probably have little long-term impact on the flora and they likely aid the wildlife population. However, the spoil piles associated with the dugouts are often unsightly and become vegetated with pioneer species that are often not native to the region.

A small part of the David Lake shoreline was hayed, but the long-term impact was not studied.

Several vehicle trails nine to 15 m wide are found in the east and west quarters of the study area. Some were cut as access routes for building fences or constructing dugouts, while others were cut for access by seismic and drilling crews. All the trails are partially vegetated with both native and introduced plant species. Some are now used for access to check livestock. Most trails are growing in to the width of the vehicles used.

The most conspicuous disturbances associated with oil and gas industry activities are seismic cutlines. Several cutlines 10 to 20 m wide have been cut and although parts of two of them are used as vehicle trails, most of them are growing back to native vegetation.

Five gas wells have been drilled in the study area. Three were abandoned and the sites no longer noticeable. The other wells were capped. The capped well sites are sparsely vegetated with crested wheat grass (Agropyron cristatum) and some pioneering native and introduced species.

People in the Wainwright region use the area for light recreation. Deer hunters come to the area in the fall and, occasionally, people camp for the weekend by the spring. The camping site and fire pit are littered with paper, bottles and other refuse.

The greatest impact on the study area is from the use of dirt bikes and three-wheeled all-terrain vehicles (ATVs) in the sand dune area. At present the impact is limited to a few blowout areas; however, the plant communities in these areas are growing on loose sand and are susceptible to trampling and agitation. Considering the growing popularity of dirt bikes, ATVs and four-wheel drive trucks, and the lack of areas for people to use these machines off the road, there is potential for increased use and consequent disturbance of the Wainwright Sandhills.

The potential for destruction of vegetation through the use of vehicles is particularly evident at the main access gate in the southeast corner (NE 1-42-5-W4). From the gate the trail crosses a low dune area. On either side of the dune there is a single vehicle trail; however, across the dune the trail separates into several tracks. Vehicular traffic breaches the dune vegetation and when the trail becomes impassable because of the loose sand (except for four-wheel drive trucks or ATVs) another trail is broken. This process continues and the area becomes criss-crossed with trails.

8. SPECIAL FEATURES

A map showing the location of the special features is presented in Figure 5.

1. Ribstone Creek: Although the creek itself does not run through the study area, the valley cuts the southwest corner of it. A fen, moist willow stands and balsam poplar forest occur along the creek. The valley is important wildlife habitat and serves as a travel corridor for many species.

2. Wallaby Lake: This is a large (75 ha) terminal and moderately saline basin with a maximum depth of about 4 m. The lake bottom and shoreline are sandy. There is little emergent vegetation but dense aquatic plants. It is an important lake for staging water birds. Game fish are not found in this lake and it is unknown if minnows or sticklebacks are present. Larval salamanders were caught along the lake's edge.

3. David Lake: This is a large (191 ha), shallow (about 1.5 m deep) and moderately saline lake. There is a variety of shoreline community types found around David Lake and an extensive stand of emergent hardstem bulrush (*Scirpus acutus*) well interspersed with water. The emergent vegetation provides good brood, nesting and escape cover for a variety of ducks, grebes, coots and Canada geese. As well, there are large numbers of shorebirds, gulls, terns, blackbirds and other songbirds which use the lake and surrounding mudflats and meadows for foraging and nesting.

4. Beaver ponds: The network of beaver ponds throughout the dune-fen complex is extensive. They range in size from 1 to 10 ha. At least six active lodges were found. All of the ponds are bordered on the upstream side by a fen and have associated with them a variety of aquatic, wet and mesic community types. The ponds are valuable wildlife habitat.

5. Spring: Except for beaver ponds and associated small streams this is the only spot where groundwater surfaces and flows above the ground. This spring surfaces in a pool with an area of about one square metre and then flows as a small creek (less than one metre wide) for about 100 m before disappearing into the ground. It then seems to run underground into a fen and then into a beaver pond before entering David Lake. Balsam poplar grow along the creek.

6. Dune-fen complex: The fens and dunes are of interest because they are unusually extensive for the Aspen Parkland and because the vegetation is different from that of the typical Aspen Parkland

that surrounds the complex. The fens are similar to the rich fens in the foothills of Alberta; fens reach the southern limit of their range in eastern Alberta at Wainwright. The dunes are well-developed, reaching a height of 30 m, and support a variety of interesting plant species, such as prickly pear cactus and poison ivy. The vegetation of the fen-dune complex differs from northern and western sites by the absence of coniferous trees: Jack pine is not found on the sand hills and neither black spruce nor larch are found in or by the fens.

7. Sloping fen: Sloping fens are unusual peatlands. This fen (Stand 39) is small (approximately 1 ha), and has a slope of 15° with a southerly aspect. Small marl pools are distributed from the top to the bottom of the fen. The vegetation is typical of fens in the study area. There are well developed bryoid, herb-dwarf shrub and low shrub layers. The dominant plants are Carex spp. and Drepanocladus spp. Three orchid species and Lobelia kalmii, uncommon in Alberta, were found in this fen.

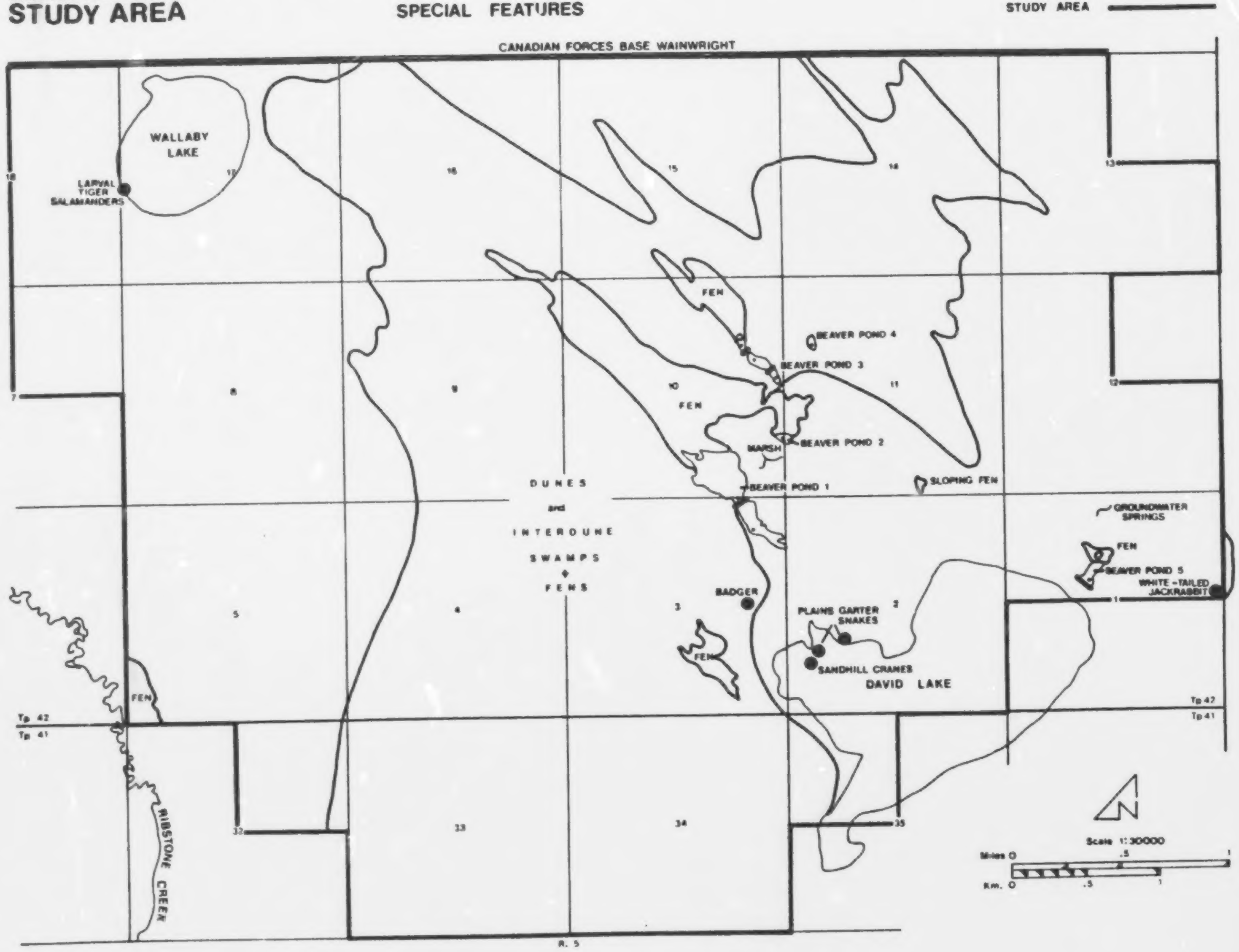
8. Tiger salamanders: Three larval salamanders were found in Wallaby Lake. This is mentioned as a special feature because this nocturnal amphibian has not been well studied and a known breeding site could be of interest to herpetologists.

9. Flora: For the small area of the study site, the flora is extensive and diverse, 406 vascular species and 81 non-vascular species have been recorded.

FIGURE 5

WAINWRIGHT STUDY AREA

SPECIAL FEATURES


STUDY AREA
CANADIAN FORCES BASE WAINWRIGHT
WALLABY LAKE
LARVAL TIGER SALAMANDERS
18
17
16
15
14
13
7
8
9
10
11
12
FEN
FEN
BEAVER POND 4
BEAVER POND 3
BEAVER POND 2
BEAVER POND 1
BEAVER POND 5
MARSH
SLOPING FEN
GROUNDWATER SPRINGS
FEN
WHITE-TAILED JACKRABBIT
DUNES and INTERDUNE SWAMPS + FENS
5
4
3
2
1
BADGER
PLAINS GARTER SNAKES
SANDHILL CRANES
DAVID LAKE
FEN
FEN
Tp 42
Tp 41
Tp 42
Tp 41
32
33
34
35
RIBSTONE CREEK
R. 5
Scale 1:30000
Miles 0 .5 1
Km. 0 .5 1

LEGEND

- • beaver lodge
- ▬ beaver dam

9. A COMPARISON OF THE WAINWRIGHT STUDY AREA AND THE CANDIDATE RUMSEY ECOLOGICAL RESERVE

The Wainwright study area and the candidate Rumsey Ecological Reserve are representative of the central section of the Aspen Parkland. Because neither site contains all Parkland ecosystems, both have been looked at as possible supplementary ecological reserves with special features.

[Information on the candidate Rumsey Ecological Reserve was obtained from Fehr (1982)].

As provincial Crown land, both areas are administered by the Public Lands Division of the Department of Energy and Natural Resources. Most of the Rumsey area has been under the grazing lease of one ranch since 1920. The Buffalo Park Grazing Association (BPGA) has held the grazing lease for most of the Wainwright area since 1948; however, within the BPGA the area is divided and administered as two ranges. It is probably important to consider the differences between the lessees of the two sites when comparing the history and nature of range use.

The two sites are complimentary and there is little overlap of features. Both are of adequate size and contain special features. The Rumsey site lies within the largest block of native Aspen Parkland in the world.

The Wainwright site is more heterogeneous than Rumsey. It includes a greater diversity of geographical features, wetlands and vegetation types and it has more extensive and diverse flora and fauna. While the Rumsey area is more homogeneous, it has been subject to less disturbance.

Hummocky disintegration moraine is found throughout most of the Rumsey area. The knob and kettle terrain, typical of such moraines, is broken only by a few moraine plateaus, a glacial spillway and an esker. Most of the Wainwright area is covered with outwash sand deposits. These deposits have been reworked by wind to form a large dune complex in the centre of the study area. Kame and disintegration moraine, an outwash plain, interdunal fens and a glacial-lacustrine complex are also found in the Wainwright site. Topography of the Wainwright site varies from rolling to undulating to level.

Drainage, primarily via groundwater flow, is moderately well developed in the Wainwright area. Wallaby Lake is a terminal basin and there are a few small isolated wet meadows and sloughs. Other wetland types found in this area include beaver ponds, small streams and a spring, fens, willow swamps and one other large lake, David Lake.

Numerous sloughs are found in the Rumsey area but there is little surface runoff as most of the sloughs are located in kettles. Differences in depth and contour results in some different vegetation types developing. Saline sloughs also support different vegetation types, but they are not common. There is intermittent surface drainage from the glacial spillway.

A more homogeneous vegetation is found in the Rumsey area. Almost three-quarters of Rumsey is grassland; only 14% of the Wainwright area is grassland. If aspen scrubland is included as grassland the total area occupied by grasslands in the Wainwright site is still only 42%. Poplar forest accounts for 41% of the area in Wainwright and 15% in Rumsey. Wetlands account for 9% of the area in Wainwright (versus 5% in Rumsey).

Grasslands in Rumsey are in very good condition and mesic sites are dominated by rough fescue. Drier sites are dominated by Artemisia frigida, Bouteloua gracilis, Koeleria cristata and Stipa spartea var. curtiseta.

Many of the grasslands in Wainwright have been overutilized and judged to be in poor to good condition. Most of the grasslands are more xeric and have less canopy cover than those in Rumsey. Rough fescue is not the dominant grass, but it is an important constituent of the more mesic and less-grazed sites. Other important grassland species include Artemisia spp., Bouteloua gracilis, Calamovilfa longifolia and Stipa spartea var. curtiseta.

Buckbrush and wolf willow - buckbrush shrubland communities were found interspersed with grasslands in both sites.

The aspen stands of mesic sites in Wainwright are similar in physiognomy and species composition to those found in Rumsey. No communities similar to the open and often stunted aspen stands found on xeric sites in Wainwright are found in Rumsey. Balsam poplar communities are found only in Wainwright.

Willow communities in the two areas are similar in physiognomy and, for the most part, species composition. In Wainwright some of the willow stands include flora commonly associated with fens and there are a greater number of willow species.

Shoreline and wet meadow vegetation is similar; however, there are species found along the beaver pond edges in Wainwright not found in Rumsey. This difference is probably due to the lack of stable permanent water in Rumsey.

Aquatic vegetation is richer and more diverse in Wainwright because of the permanent beaver ponds.

Fen vegetation and most of the species associated with fens are found only in Wainwright. Rumsey lacks sand dune areas and consequently does not support dune vegetation or the associated xerophyllic species, such as Carex foenea and Hudsonia tomentosa that are found at Wainwright.

Brush invasion is occurring in both areas. In Rumsey there has been a 15% decrease in area occupied by grassland and a concurrent increase in aspen poplar area between 1907 and 1979. In Wainwright, between 1903 - 1904 and 1982, there was a 23% increase in aspen and balsam poplar forest and a concurrent 13% decrease in grassland and a 7% decrease in scrubland.

The vascular flora of the Rumsey area consists of 291 species distributed among 49 families and 158 genera. The vascular flora of Wainwright consists of 406 species distributed among 62 families and 205 genera. Compositae and Gramineae are the most species-rich families in both areas. Other families important to both areas include Cyperaceae, Leguninosae, Ranunculaceae and Cruciferae. Salicaceae is important only in Wainwright and Rosaceae only in Rumsey. *Carex* is the most species-rich genera in both areas. Species-rich genera common to both areas include *Agropyron*, *Potentilla* and *Ranunculus*. *Equisetum*, *Potamogeton*, *Salix* and *Solidago* are important in Wainwright while *Astragalus* and *Poa* are important in Rumsey.

Both sites are important refugia for wildlife. Eighty-one bird, 22 mammal and six reptile and amphibian species are known from Rumsey; 121 bird, 31 mammal and five reptile and amphibian species are known from Wainwright.

Disturbances in both areas are associated with oil and gas industry activities and ranching operations; however, disturbances are more recent in the Wainwright area. The grazing rights of the Rumsey area have been in the hands of one ranch for more than 60 years, the same grazing system has been used for many years and consequently there have been no recent major changes in the range.

The range condition of the Rumsey area is very good. Range condition of the Wainwright area varied from poor to good in the late 1970s. A range management plan was designed and is now being implemented. Most disturbances are associated with the institution of the plan and will recover with time. The cultivated grassland is probably the only disturbance that will have a long-lasting impact in the Wainwright area.

10. RECOMMENDATIONS FOR FUTURE MANAGEMENT

Listed below are management recommendations for the Wainwright site if it achieves ecological reserve status.

1. An ecological reserve in the Wainwright Sandhills should be established and encompass all the lands included in the study site. The outer regions of the area would act as a buffer zone to the central sand dune-fen complex. The disturbed sites, most of which are located in the outer regions, would gradually return to their natural states.

2. No further cultivation of grasslands and cleared areas should be allowed. The two 16 ha plots of cultivated ground should be reseeded to native plant species using zero-tillage techniques.

3. No further seeding of domestic plant species should be allowed.

4. The impact of brush invasion on the Wainwright site should be determined; if brush clearing is considered necessary for the management of the site, it should be accomplished through the use of fire. Fire simulates a natural process and is preferred over chemical or mechanical means.

5. The construction of new fences, roads and dugouts should not be allowed. The improvements required for implementation of the rotational grazing system are already in place. Cutlines that were made for fences or roads should be allowed to grow in and only those roads necessary for ranching operations should remain. Dugout spoil piles should be spread and revegetated with native pioneering species.

6. If grazing is to continue once the site is established as an ecological reserve, the rotational grazing system must be retained using light stocking rates. The effects of grazing should be monitored and if vegetation is still being damaged the grazing policy should be reviewed.

7. Oil and natural gas industry activity should be restricted to servicing of the two capped wells.

8. Vehicle use should be restricted to ranchers requiring access to their cattle. Travel into the area by visitors should be by foot or restricted horseback use. These restrictions would decrease disturbances to wildlife and prevent damage to vegetation.

9. Signs should be posted indicating that the area is an ecological reserve. An information brochure should be written to inform interested people of the significance of the area.

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12. PERSONAL COMMUNICATIONS

Loonen, H. 1983.
Range manager, Wainwright. Alberta Public Lands Division.

Maull, R. 1983.
Rancher in the region of the study area and Director of BPGA range 5.

Roberts, W. 1983.
Curator, University of Alberta's Zoology Museum.

APPENDIX 1

LAND DISPOSITIONS

LEGEND

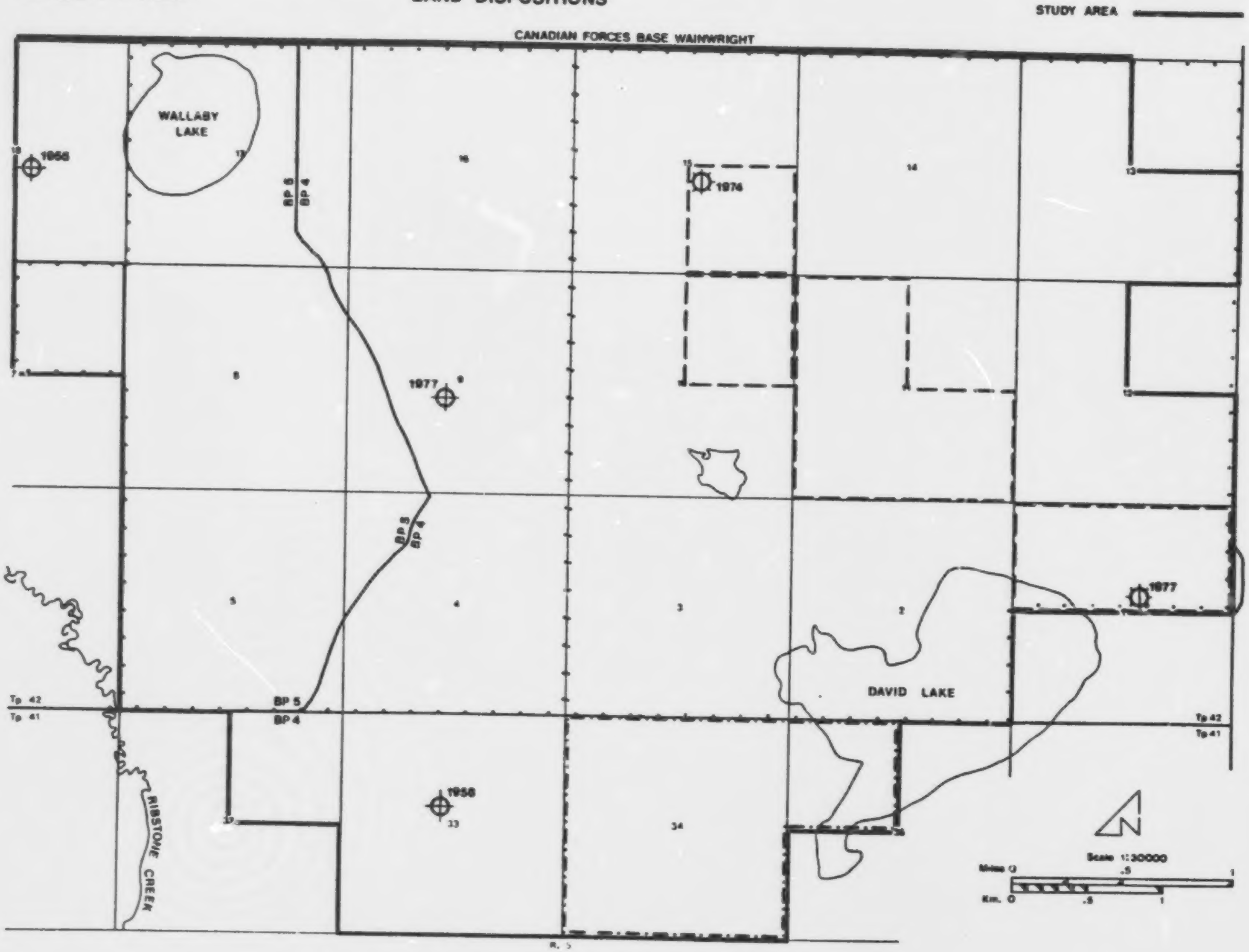
Entire area, except NE 7-42-5-W4, under lease to Buffalo Park Grazing Association (BPGA), GRL 038839; NE 7-42-5-W4 under GRL 033916.

⁓	Fenceline dividing GRL 038839 into separate ranges
BP4	Buffalo Park G.A. 4 (Director: Ralph Maull)
BP5	Buffalo Park G.A. 5 (Director: Allan Currier)
⊕	Abandoned gas well
☼	Capped gas well
⬚	Mineral surface lease
-·-·-	Mineral lease (PNG): British Petroleum Exploration Canada Ltd.; Canada-Cities Service Ltd., Dome Petroleum Ltd.; Murphy Oil Co. Ltd.; Canpar Holdings Ltd. Expires: September 1984.
· · · · · ·	Mineral Lease (PNG): Kissinger Petroleum Ltd.; Many Islands Pipe Lines Ltd. Expires: March 1985.

APPENDIX 1

WAINWRIGHT STUDY AREA

LAND DISPOSITIONS


STUDY AREA
CANADIAN FORCES BASE WAINWRIGHT
WALLABY LAKE
DAVID LAKE
RIBSTONE CREEK
18
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1956
1974
1977
1977
1958
BP 5
BP 4
Tp 42
Tp 41
R. 5
Scale 1:30000
Miles 0 .5 1
Km. 0 .5 1

APPENDIX 2

SOIL PROFILES AND CLASSIFICATION

Plot No.	Vegetation	Landform	Classification	Depth (cm)	Horizon	Texture
1	*Koeleria* - *Calamovilfa*	Outwash plain	Dark Brown Chernozem	0-15	Ah	medium sand
				15-27	Bm	medium sand
				27-55	BC	medium sand
				55+	C	medium sand
2a	*Populus tremuloides* - herbs	Outwash plain	Dark Brown Chernozem	3- 0	LFH	-----
				0-11	AL	medium sand
				11-23	Bm	medium sand
				23	BC	medium sand
2b	*Koeleria* - *Calamovilfa*	Outwash plain	Dark Brown Chernozem	---	--	medium sand
3a	*P. tremuloides*	Aeolian dunes	Orthic Regosol	3.5-0	LFH	
				0-22	C_1	medium sand
				22-56	C_2	medium sand
				56	C_3	medium sand
3b	*Carex* - *Elymus*	Aeolian blowout	Orthic Regosol	---	C	fine to medium sand
4	*P. tremuloides* - *Salix*	Depressional aeolian	Dark Brown Chernozem	7- 3	C_1	medium sand
				3- 0	LFH	medium sand
				0-18	Ah	medium sand
				18-20	Bm	medium sand
				29	C_2	medium sand
5	*Carex* - *Betula* (fen)	Meltwater channel	Fibric Mesisol	upper tier - Fibric (Von Post: 3-4)		
				middle tier - Mesic (Von Post: 6)		
6	*P. balsamifera*	Meltwater channel	Gleyed Brown Chernozem	4- 0	LFH	-----
				0-17	Ah	loamy sand
				17-33	Bm	loamy sand - sand
				33-53	BCgj	medium sand
				53+	Cgj	medium sand

Plot No.	Vegetation	Landform	Classification	Depth (cm)	Horizon	Texture
7	*P. balsamifera*	Outwash-Lacustrine complex	Gleyed Dark Gray Chernozem	20- 0	LFH	-----
				0-16	Ahe	silty loam to fine sandy loam
				16-28	Ahgj	loamy sand to sandy loam
				28+	Cgj	loamy sand to sand
8	*Salix* - *Betula*	Outwash-Lacustrine complex	Fibric Mesisol	---	Of	fibric
				---	Om	mesic
9	*Koeleria* - *Festuca*	Aeolian dunes	Dark Brown Chernozem	3- 0	LH	medium sand
				0-17	Ah	medium sand
				17-26	Bm	medium sand
				26-47	BC	medium sand
				47+	C	medium sand
10	*P. tremuloides* - *lichen*	Aeolian dunes	Orthic Regosol	0-17	C_1	medium sand
				17+	C_2	medium sand
11	*Koeleria* - *Antennaria*	Outwash-Lacustrine complex	Gleyed Calcareous Dark Brown Chernozems	0-26	Ahk	loamy sand
				26-43	Bmk	loamy sand
				43+	Ckg	loamy sand
12	*Carex* - *Betula* (fen)	Outwash plain	Mesisol	---	--	-----
13	*Carex* - *Betula* (fen)	Organic	Mesisol	---	--	-----
14	*Salix*	Aeolian dunes	Rego Gleysol Gleysol	9- 0	LFH	
				0-10	Ah	medium sand
				10-14	LH bands	medium sand
				14-34	C	medium sand
				34+	Cg_1	medium sand
					Cg_2	medium sand
15	*P. tremuloides* - *Rosa*	Ablation moraine	Orthic Brown Chernozem	4- 0	LFH	
				0-14	Ah	fine sandy clay loam
				14-30	Bm	fine sandy clay loam
				30-45	BC	clay loam
				45+	Ck	clay loam

APPENDIX 3

STAND DESCRIPTION FORM

Veg. Plot No.	Project I.D.	Legal	Location:
1.	8.	14.	

Biog. Z.	IBP Code	Veg. Type	Landform	Elevation	Slope	Aspect	Soil
21.	23.	28.	32.	36.	40.	42.	44.

Sociation Name:

Site Position Diagram (refer to data form no. ____________________)

Photo roll no. ________

Photo no. ________

Scale

Direction ⟷

General Description and Remarks:

47.	48.	49.	50.	51.
Moisture Regime	Drainage	Site Position	Stability Index	Microtop
1. very xeric	rapidly	crest	unstable	smooth
2. xeric	well	upper slope	rapid change	micro-mound
3. subxeric	mod. well	middle slope	mod. change	slightly mound
4. submesic	imperfectly	lower slope	slow change	mod. mound
5. mesic	poorly	toe	stable	strongly mound
6. subhygric	very poorly	depression	climax	severely mound
7. hygric		level		extr. mound
8. subhydric				ultra mound
9. hydric				

Rock	Humus	Min. Soil	Deadfall	Water	T. Unveg.
52.	54.	56.	58.	60.	62.

% Cover	Species	Cover	Av. Hgt.	DBH	Rings
Tree C. I 64.					
Tree C. II 66.					
Shrub C. I 68.					
Shrub C. II 70.					

72. Herb Dwarf Shrub 74. Bryoid

Plot No. 1.

Date: ______

Other Obs: ______

LYR	CODE	%	SPECIES	LYR	CODE	%	SPECIES
8.	10.	14.					

APPENDIX 4

TERRAIN AND SOILS OF THE WAINWRIGHT STUDY AREA

By Wayne S. Tedder

Eight different landscape systems were mapped (Figure 2 in biophysical report).

Area I - Outwash Plain

The outwash plain unit consists of undulating to subdued topography with slopes generally in the 2 - 5% range. The plain is located at 678 to 686 m ASL in the western area and up to 693 m ASL in the eastern area.

The material is predominantly medium sand with gravels generally forming less than 5%. Stone content can occasionally be significantly greater. Stones are sometimes found at the ground surface.

Orthic Dark Brown Chernozems are the dominant soil profiles. This profile has developed in the sand and carbonates are not present in the top 50 cm. The soil structure is single grain with a loose consistency. The pH of the profile ranged from 5.8 to 7.8.

Numerous blowouts (inactive) were observed. Aeolian veneers are expected to be present over much of this area as a result of the sand removed from blowouts and the sandy texture of the outwash. The dominant soil profile in the aeolian veneer is expected to be a stone-free Dark Brown Chernozem.

Area II - Meltwater Channel

A small portion of an extensive meltwater channel crosses the southwest corner of the study area. Here it is approximately 0.5 km wide. The channel is occupied by an underfit stream and most of the channel floor is very poorly drained. Organic and gleysolic soils are dominant. The water table is at or near the surface. A Fibric Mesisol was encountered and mineral soil was not reached at a depth of 1 m. Vegetation consists of sedge, dwarf birch and willow.

Along the margin of the channel floor are stone free, sandy glaciofluvial or fluvial deposits. They are well to imperfectly drained loamy sands and sands. A Gleyed Black Chernozem is located under a balsam poplar canopy. The pH of the profile is 8.0 throughout.

The channel floor is at 671 m ASL.

Area III - Aeolion Dunes

An extensive dune field is located in the central part of the area. It is characterized by poorly-formed dunes aligned in a NW to SE orientation and numerous blowouts. The dune-forming wind direction was from the NW. A ridged surface expression is characteristic, although subdued and hummocky areas are also present. Only those areas containing definite aeolian forms were included in this unit. The parent material is medium sand with a pH of 7.0.

The soil profiles range from Regosolic to Chernozemic, reflecting the varying ages of the deposits within this unit. This variance is because of the different periods of wind activity that local areas have experienced. Regosolic soils are present in active blowouts and on young aeolian deposits. Brunisolic and Dark Brown Chernozems may be found on older, more stabalized dunes. These soils are well to rapidly drained, stone free sands.

Slopes on the steeper dunes are up to 65% but the dunes are, for the most part, stabilized with vegetation. Slopes up to 65% are present on the steeper dune slopes. Elevation of this unit is between 678 and 693 m ASL.

Area IV - Depressional Aeolion

There are several depressional areas found within and adjacent to the dunes. They are an undulating complex of well- and poorly-drained aeolion sands. The poorly-drained depressional areas are thought to be related to the level of the water table.

Under willow cover, Rego Humic Gleysols and small areas of organic soils are present. Buried horizons are the result of recent accumulation of aeolian material from adjacent areas. The texture is medium stone-free sand.

Under aspen cover on the better drained sites, Dark Brown Chernozems have developed. A 3 cm thick LFH horizon is common in this profile. The pH is 5.5 in the Ah horizon and 7.0 in the parent material. Several centimetres of recent aeolian sand may be present on the soil surface.

Area V - Kame Moraine

This system consists of moderate relief, rolling terrain and is located along the northern border at elevations of 686 to 724 m. Although no sites were visited in this system, it is expected that the soils are sandy textured, well-drained Dark Brown Chernozems. A veneer of aeolion sand may be present in some areas.

Area VI - Ablation Moraine

This system is located in the extreme northeast of the study area. It consists of high relief rolling topography with slopes up to 30 - 40%. Well-drained Orthic Black Chernozems are present under dense aspen cover. The topsoil is sandy loam to sandy clay loam while the subsoil is clay loam. The pH within the profile ranges from 6.8 to 7.8. A thin LFH horizon is characteristic. Dark Brown Chernozems may be present under the natural grasslands, although no pits were examined in those areas.

The elevation of this landscape ranges from 709 to 732 m ASL, the highest in the study area.

Area VII - Organic

Several small organic deposits are located within the dune field at elevations ranging from 678 to 686 m ASL. The profile consists of mainly mesic peat with minor fibric layers. The water table is at the soil surface. Mineral soil was not reached at a depth of 80 cm.

Area VIII - Outwash - Lacustrine Complex

This system borders David Lake and was mapped as a complex because it is composed of numerous small units. When David Lake was at a higher level, it inundated an area of outwash sand. In lower elevations, lacustrine deposits were laid down. These deposits were mainly reworked outwash with some silts and clays added to give them a loamy sand texture. Higher elevation knobs of outwash formed islands, lower elevation knobs were washed and subdued in relief by the lake waters.

The soils consist of Gleyed Calcareous Dark Brown Chernozems on the low relief knobs that were once under lake waters. In the lowest elevations, Gleysols and some organic soils are present. The highest elevation sites are expected to have Orthic Dark Brown Chernozems on the grasslands and possibly Dark Gray Chernozems under aspen cover.

APPENDIX 5

ANNOTATED LIST OF THE NON-VASCULAR AND VASCULAR FLORA OF THE WAINWRIGHT STUDY AREA

NON-VASCULAR PLANTS

1. Lichens

*_Caloplaca holocarpa_ - Considered common by Bradley and Bradley (1977).

Cetraria ericetorum - Very common in stable blowouts; common in interdune depressions and dry grasslands.

Cetraria halei - On willows in poplar stands.

*_Cetraria islandica_ - Common. Dry grasslands in dunes.

#_Cetraria nivalis_ - Common in stable blowouts; fairly common in interdune depressions and dry grasslands.

*_Cetraria pinastri_ - Uncommon. On a birch tree.

Cladonia chlorophaea - Dry grasslands, stable blowouts and aspen stands.

#_Cladonia coccifera_ - Dry grasslands and interdune depressions.

Cladonia coniocraea - Interdune depression.

Cladonia cristatella - Sand dunes.

#_Cladonia mitis_ - Very common. Interdune depressions, stable blowouts, dune aspen stands and dry grasslands.

Cladonia phyllophora - Interdune depression.

*_Cladonia pocillum_ - Grasslands.

#_Cladonia pyxidata_ - Fairly common. Dry grasslands, stable blowouts and interdune depressions.

Cladonia uncialis - Interdune depression.

#_Cornicularia aculeata_ - Common. Dry grasslands, stable blowouts, and interdune depressions.

*_Diploschistes sp._ - Recorded in the study area.

#_Evernia mesomorpha_ - Occasional. On willows, logs and soil.

Hypogymnia physods - On willows in fens.

**Letharia vulpina* - Rare. On logs in dune grasslands.

#*Parmelia chlorochroa* - Occasional. Grasslands and stable blowouts.

Parmelia flaventior - On willows in fens.

Parmelia septentrionalis - On willows in willow stands.

#*Parmelia sulcata* - On willows, poplars and rotting logs in woodlands.

Parmeliopsis hyperopta - On willows in willow stands.

Peltigera canina - Occasional. On humus in willow and buckbrush stands; also in interdune depressions.

#*Physcia aipolia* - On willows in willow stands.

Physcia orbicularis - On willows in willow and poplar stands.

Physcia stellaris - On willows in willow stand.

Physia adscendens - On willows in willow and aspen stands.

Xanthoria fallax - On willows in willow and aspen stands.

2. Mosses

Amblystegium serpens - Aspen stand.

Amblystegium varium - Willow stand.

#*Aulacomnium palustre* - Fairly common. On hummocks and strings in fens, also on hummocks in willow stands.

Brachythecium ellipticum - Willow stand.

Brachythecium salebrosum - Aspen and buckbrush stands, on humus and dead logs.

#*Brachythecium turgidum* - Occasional. Flarks in fens.

Bryum pseudotriquetrum - Occasional. Willow stands and on hummocks or in flarks of fens.

Calliergon giganteum - Wet sites in the sloping fen and in a wet site in a willow stand.

Calliergon stramineum - Flark of large fen.

Campylium chrysophyllum - Damp areas of main fen.

Campylium hispidulum - Moist to wet willow stand.

Campylium polygamum - On ground of a willow stand.

Campylium stellatum - Sloping, large and Ribstone (next to creek in southwest corner) fens.

Ceratodon purpureus - Large fen and an aspen stand on the north slope of a dune.

#Climacium dendroides - Fens.

Dicranum fuscescens - Aspen stand.

Dicranum muehlenbeckii - Stable blowouts and dry aspen stands.

*Dicranum polysetum - On hummocks in fens.

Dicranum undulatum - Willow stand.

Distichium capillaceum - Willow stand.

Drepanocladus aduncus - Fens.

Drepanoacladus exannulatus - Fen.

Drepanocladus revolvens - Wet areas in willows and fens (often in flarks).

Drepanocladus sp. - Common. Wet meadows, fens (flarks and strings) and wet sites in willows.

#Helodium blandowii - Fairly common. On hummocks in fens and wet willows, and in moist aspen stands.

Hypnum cupressiforme - Wallaby Lake shore.

Hypnum pratense - Main fen.

Leptobryum pyriforme - High spots in fens.

Lophocolea heterophylla - Main fen.

Meesia hexasticha - Flarks of main fen.

Meesia triquetra - Fens on strings and in flarks.

Orthotrichum speciosum var. elegans - Willow stands in fens.

*Plagiomnium cuspidatum - Hummocks in fens and in moist woods.

Plagiomnium ellipticum - Willow stands and hummocks and dry sites in fens.

Plagiothecium laetum - Main fen.

*_Pleurozium schreberi_ - Moist aspen groves.

Pohlia nutans - Main fen and shore of Wallaby Lake.

Pohlia wahlenbergii - Balsam poplar stand by the spring.

Polytrichum juniperinum - Interdune depression.

#_Polytrichum piliferum_ - Dunes and dry grasslands.

Pylaisiella polyantha - Common. Bases of trees or on dead wood.

*_Sphagnum angustifolium_ - Tops of hummocks in fens.

*_Sphagnum rujssonii_ - Tops of hummocks in fens.

Sphagnum squarrosum - Occasional. Hummock tops in main fen, especially at edge of fen in willow stands.

#_Sphagnum teres_ - Uncommon. Main fen.

#_Sphagnum warnstorfii_ - Occasional. Hummock tops in main fen, especially at edge of fen in willow stands.

Splachnum ampullaceum - High spot in main fen.

Thuidium recognitum - Damp poplar and willow stands.

#_Tomenthypnum nitens_ - Common. Sides of hummocks in fens and wet willow stands, and occasionally in dry sections of flarks.

#_Tortula ruralis_ - Fairly common. Blowouts, interdune depressions and open dry aspen stands.

*_Usnea_ sp. - On willows in depressions.

VASCULAR PLANTS

Polypodiaceae

Cystopteris fragilis - Uncommon. One plant found in balsam poplar forest.

Equisetaceae

#*Equisetum arvense* - Common. Moist woods.

Equisetum fluviatile - Occasional. Fens and at edges of beaver ponds; emergent.

#*Equisetum hyemale* - Fairly common. Sand dunes, blowouts, sandy grasslands and scrub aspen stands.

Equisetum palustre - Uncommon. Wet and moist woods.

Equisetum pratense [illegible] Moist woods.

#*Equisetum variegatum* - Fairly common. Fens.

Selaginellaceae

#*Selaginella densa* - Common. Dry grasslands and dunes.

Pinaceae

#*Juniperus communis* - Occasional. Dunes, interdune depressions and open scrub aspen stands.

#*Juniperus horizontalis* - Common in grasslands, blowouts, dunes, sandflats and hummocks in fens; occasional in aspen forests.

Typhaceae

#*Typha latifolia* - Beaver ponds, David Lake and some fens and dugouts; emergent.

Sparganiaceae

Sparganium chlorocarpum - Occasional. Beaver ponds and ponds within fens; emergent.

Sparagnium minimum - Occasional. Beaver ponds and ponds within fens; emergent.

Najadaceae

Potamogeton filiformis - Wallaby Lake and David Lake; submergent.

Potamogeton friesii - Large beaver pond; submergent.

Potamogeton gramineus - Beaver ponds; submergent.

Potamogeton pusillus - Beaver ponds and a dugout; submergent.

Potamogeton richardsonii - Wallaby Lake and large beaver pond; submergent.

Potamogeton vaginatus - Wallaby and David Lakes and large beaver pond; submergent.

Potamogeton zosteriformis - Large beaver pond; submergent.

Ruppia occidentalis - David Lake; submergent.

Juncaginaceae

#*Triglochin maritima* - Fairly common. Fens and moist shorelines.

#*Triglochin palustris* - Occasional. Fens and moist locations around beaver ponds.

Alismaceae

#*Alisma plantago-aquatica* - Uncommon. One beaver pond and small pond near the large beaver pond.

#*Sagittaria cuneata* - Occasional. Most beaver ponds and some dugouts.

Hydrocharitaeae

Elodea canadensis - Pools in willows and some beaver ponds.

Gramineae

Agropyron cristatum - Introduced. Seeded at two well sites.

#*Agropyron dasystachyum* - Occasional. Grasslands.

Agropyron desertorum - Introduced. Planted in the two cultivated fields.

Agropyron repens - Occasional. Throughout study area.

#*Agropyron smithii* - Occasional. Grasslands.

#*Agropyron subsecundum* - Fairly common. Buckbrush stands, scrub aspen stands, moist grasslands and dunes.

#*Agropyron trachycaulum* - Occasional. Grasslands.

Agropyron trichophorum - Introduced. Seeded in cultivated fields.

#*Agrostis scabra* - Fairly common. Disturbed areas, interdune depressions and willows.

#*Alopecurus aequalis* - Willow swamps and edge of Wallaby Lake.

Avena sativa - Introduced. Planted in cultivated fields.

#*Beckmannia syzigachne* - Uncommon. Beaver ponds and wet meadows.

#*Bouteloua gracilis* - Fairly common. Moist grasslands.

#*Bromus anomalus* - Occasional. Shrub stands (buckbrush and wolf willow) and moist grasslands.

Bromus biebersteinii - Introduced. Planted in cultivated fields.

#*Bromus ciliatus* - Occasional. Fens, balsam poplar stands and some aspen poplar and willow stands.

#*Bromus inermis* - Fairly common. Throughout study area in aspen poplar stands, disturbed areas and grasslands.

#*Calamagrostis canadensis* - Occasional. Moist areas by beaver ponds, willow stands and balsam poplar forests.

#*Calamagrostis inexpansa* - Fairly common. Marshes, balsam poplar and willow stands and edges of lakes and ponds.

#*Calamovilfa longifolia* - Common. Grasslands on dunes and blowouts.

#*Danthonia intermedia* - Occasional. Grasslands.

#*Deschampsia caespitosa* - Fairly common. Moist areas near ponds, balsam stands and wet meadows.

Distichlis stricta - Fairly common. Saline grasslands, especially by David Lake.

Elymus angustus - Introduced. Planted in cultivated fields.

#*Elymus canadensis* - Fairly common. Sandy areas, especially on dunes, in blowouts and Wallaby Lake shoreline.

#*Festuca saximontana* - Common. Grasslands on dunes, blowouts and interdune depressions.

#*Festuca scabrella* - Fairly common in moist grasslands; occasional in drier areas.

Glyceria borealis - Beaver ponds.

#*Glyceria grandis* - Common. Wet meadows, around beaver ponds and wet areas in willows.

#_Glyceria striata_ - Fairly common. Wet areas at pond and lake edges, wet meadows, fens and beaver dams.

#_Helictotrichon hookeri_ - Occasional. Grasslands and open woodlands.

#_Hierochloe odorata_ - Occasional. Dry grasslands.

#_Hordeum jubatum_ - Common. Throughout study area.

#_Koeleria cristata_ - Common in dry grasslands and dunes; occasional in aspen and buckbrush stands.

Muhlenbergia glomerata var. _cinnoides_ - Uncommon. Fens.

*_Muhlenbergia richardsonis_ - Uncommon. Dune grasslands.

Oryzopsis asperefolia - Edge of aspen groves.

#_Oryzopsis hymenoides_ - Dune areas, blowouts and grasslands.

Oryzopsis pugens - Aspen groves.

Phalaris arundinaceae - Occasional. Shores of beaver ponds and David Lake.

Phleum pratense - Occasional. Balsam poplar stands and fens.

Poa arida - Uncommon. Scrub aspen on dunes.

#_Poa interior_ - Fairly common. Grasslands, buckbrush and scrub aspen.

Poa palustris - Common. Throughout study area in moist or wet areas including aspen, balsam, willow, buckbrush and wolf willow stands, wet meadows, beaver pond and lake edges and fens.

Poa pratensis - Common. Moist woodlands, lake and pond edges and grasslands.

Puccinellia nuttalliana - Fairly common. Saline meadows north of David Lake, Wallaby Lake shoreline and wet meadows.

Schizachne purpurascens - Occasional. Aspen and balsam poplar stands and fens.

Scolochloa festucacea - Rare in study area. South end of David Lake.

Setaria viridis - Uncommon. Disturbed and sandy ground. Found by the spring where cattle concentrate.

#_Sporobolus cryptandrus_ - Uncommon. Open aspen stands and sand dunes.

Stipa comata - Fairly common. Grasslands.

Stipa spartea var. curtiseta - Common. Grasslands and shrub communities within the grasslands.

Cyperaceae

Carex aquatilis - Common. Fens, David Lake shoreline and wet meadows.

*Carex atherodes - Wet meadows and marshes.

Carex aurea - Occasional. Moist balsam stands and on shores of David and Wallaby Lakes.

Carex canescens var. subloliacea - Uncommon. Willows and by beaver ponds.

Carex capillaris var. elongata - Occasional. Fens and poplar stands.

Carex crawfordii - Occasional. Willows and beaver ponds.

Carex diandra - Fairly common. Fens, wet meadows and shores of beaver ponds.

Carex disperma - Occasional. Fens and willow stands.

Carex douglasii - Identification not positive as no females were available. Grasslands.

#Carex eleocharis - Uncommon. Grasslands.

*Carex filifolia - Dry grasslands; colonizes bare soil.

Carex foenea - Common. Dunes, blowouts, interdune depressions and some aspen stands. Pioneer species of sandy soils.

Carex heliophila - Uncommon. Sandy areas such as blowouts.

Carex interior - Occasional in fens. Found in willows and moist aspen stands.

Carex lasiocarpa - Common. Moist and wet places such as fens, wet meadows, and shorelines of lakes and beaver ponds.

Carex limosa - Common. Fens.

Carex livida - Fairly common. Fens.

Carex obtusata - Fairly common. Grasslands on dunes and blowouts.

Carex parryana - Uncommon. David Lake shore.

Carex praegracilis - Fairly common in wet meadows, fens, shores, buckbrush stands; occasional in grasslands.

Carex prairea - Fairly common. Fens, wet meadows and willows.

#*Carex rostrata* - Common. Marshes, fens, wet meadows, willows and shores.

Carex sartwellii - Fairly common. Fens, wet meadows and edge of ponds and lakes.

Carex sprengelii - Occasional. Poplar forests and wolf willow stands.

Carex vaginata - Occasional. Moist poplar forests and willow stands.

Carex viridula - Occasional. Fens, balsam poplar stands and shorelines.

**Cyperus schweinitzii* - Rare. Active blowout. Formerly known only from southern Alberta.

Eleocharis acicularis - Uncommon. Fens on moist shorelines.

Eleocharis compressa - Rare. Fens.

Eleocharis palustris - Common. Wet meadows, marshes, willows and shorelines.

#*Eleocharis pauciflora* var. *fernaldii* - Uncommon. Fens.

#*Eriophorum angustifolium* - Occasional. Fens.

Eriophorum chamissonis - Occasional. Fens.

Eriophorum viridi-carinatum - Fairly common. Fens.

Scirpus acutus - Fairly common. Marshes, David Lake and beaver ponds; emergent.

Scirpus americanus - Occasional. Saline shores, especially around David Lake.

Scirpus caespitosus var. *callosus* - Occasional. Fens.

#*Scirpus microcarpus* - Occasional. Beaver ponds and moist balsam-willow forests.

#*Scirpus validus* - Uncommon. Beaver ponds.

Lemnaceae

#_Lemna minor_ - Occasional. Dugout, willow swamp, slough and beaver ponds; floating aquatic.

#_Lemna trisulca_ - Fairly common. Beaver ponds, willow swamp and slough; floating aquatic.

Juncaceae

Juncus alpinus var. _rariflorus_ - Uncommon. Fens and willow stands.

#_Juncus balticus_ - Common. Grasslands, interdune depressions, balsam-willow groves and shores of ponds and lakes.

Juncus bufonius - Uncommon. Edge of dugout.

Juncus longistylis - Uncommon. Fen.

Juncus nodosus - Uncommon. Fens and moist woodlands.

Liliaceae

*_Allium textile_ - Uncommon. Grasslands.

Disporum trachycarpum - Occasional. Moist woodlands.

#_Lilium philadelphicum_ - Uncommon. Grasslands on dunes and hummock tops in fens, often near shrub stands.

#_Maianthemum canadense_ - Fairly common. Older moist poplar and willow stands.

#_Smilacina stellata_ - Fairly common. Moist poplar and willow stands.

Smilacina trifolia - Occasional. Balsam poplar and willow stands.

#_Tofieldia glutinosa_ - Occasional. Fens.

#_Zygadenus elegans_ - Occasional. Fens and willow stands.

Iridaceae

#_Sisyrinchium montanum_ - Occasional. Grasslands.

Orchidaceae

#_Corallorhiza trifida_ - Uncommon. Fens and moist willow stands.

#_Cypripedium calceolus_ - Rare. Found in two fens in the study area.

#_Habenaria dilatata_ - Fairly common. Fens.

#_Habenaria hyperborea_ - Fairly common. Fens.

Habenaria obtusata - Uncommon. Moist balsam poplar and willow stands.

Habenaria viridis - Rare. Willow stand.

Salicaceae

#Populus balsamifera - Fairly common. Moist sites around beaver ponds, lakes and wet meadows.

#Populus tremuloides - Common. Throughout the study area.

#Salix bebbiana - Common. Throughout the study area in poplar stands, on wet, moist or dry sites and in interdune depressions.

#Salix candida - Common in fens. Occasional on shorelines.

Salix discolor - Uncommon. Mesic and wet areas.

*Salix interior - Wet areas.

*Salix lutea - Wet areas.

Salix maccalliana - Uncommon. Wet areas around David Lake, beaver ponds and fens.

Salix myrtillifolia - Locally abundant. Wet areas.

#Salix pedicellaris var. hypoglauca - Fairly common. Fens.

#Salix petiolaris - Fairly common. Fens on hummocks, around water bodies and in wet meadows.

Salix planifolia - Fairly common. Wet areas around David Lake and beaver ponds and hummocks in fens.

Salix pseudomonticola - Uncommon. Moist poplar stands and wet areas.

*Salix pyrifolia - Wet areas.

Salix serissima - Occasional. Fens and around beaver ponds and lakes.

Betulaceae

*Alnus tenuifolia - Sporadic. Edge of moist woods.

*Betula occidentalis - Occasional. Woods near water.

#Betula papyrifera - Fairly common. Dune depressions, moist poplar stands and willow stands.

#Betula pumila var. glandulifera - Common. Fens and some moist willow stands.

#Corylus cornuta - Fairly common. Moist woodlands.

Urticaceae

#Urtica gracilis - Occasional. Wet areas, especially along the spring and on beaver dams and lodges.

Santalaceae

#Commandra pallida - Fairly common. Dry grasslands and open scrub aspen stands.

Polygonaceae

#Polygonum amphibium var. stipulaceum - Includes forma fluitans and forma hirtuosum. Wet areas, including wet meadows and edges of beaver ponds and David Lake.

#Polygonum convulvulus - Occasional. Disturbed areas such as dugout spoil piles and cultivated areas.

Polygonum lapathifolium - By the spring.

Polygonum prolificum - Balsam poplar stand.

#Polygonum ramosissimum - Edge of dugout.

Rumex acetosella - Cleared area.

Rumex maritimus - Balsam poplar stand.

*Rumex mexicanus - Fairly common. Dry meadows.

#Rumex occidentalis - Wet woods and moist fens.

Chenopodiaceae

#Chenopodium album - Common. Disturbed areas (dugout spoil piles, cultivated areas and road sides).

#Chenopodium pratericola - Occasional. Dry grasslands.

Monolepis nuttalliana - Disturbed grasslands.

Salicornia rubra - Fairly common. Moist saline areas.

Suaeda depressa - Fairly common. Moist saline areas.

Nyctaginaceae

#Mirabilis hirsuta - Uncommon. Grasslands and sand dunes.

Caryophyllaceae

Arenaria lateriflora - Occasional. Aspen and balsam poplar stands.

#_Cerastium arvense_ - Fairly common in grasslands; occasional in open aspen stands.

Cerastium nutans - Moist ground in marshy area.

*_Lychnis drummondii_ - Rare. Dune grasslands and disturbed areas near beaver ponds.

*_Stellaria crassifolia_ - Fens.

#_Stellaria longifolia_ - Occasional. Moist areas in fens and willow stands.

#_Stellaria longipes_ - Common. Moist woodlands and edges of ponds and lakes.

Ceratophyllaceae

Ceratophyllum demersum - Beaver ponds and dugouts; aquatic.

Ranunculaceae

#_Actaea rubra_ - Occasional. Balsam poplar and willow woodlands and hummocks in fens.

#_Anenome canadensis_ - Fairly common. Moist grasslands, open areas of aspen and balsam poplar forests and shrubby areas.

#_Anenome cylindrica_ - Occasional. Grasslands.

Anenome multifida - Rare. Grasslands near David Lake.

#_Anenome patens_ var. _wolfgangiana_ - Fairly common. Dry grasslands.

*_Caltha palustris_ - May not occur in study area. Found in the David Lake drainage area.

*_Delphinium_ sp. - Uncommon. Grasslands.

*_Ranunculus abortivus_ - Uncommon. Wet ground.

*_Ranunculus aquatilis_ - Wet site near beaver lodge.

#_Ranunculus circinatus_ var. _subrigidus_ - Fairly common. Beaver ponds and standing water in willow swamps; aquatic.

#_Ranunculus cymbalaria_ - Fairly common. Edge of beaver ponds, sloughs and David Lake and wet meadows.

#_Ranunculus gmelinii_ - Fairly common. Beaver ponds and creeping on mud at water's edge; aquatic.

#*Ranunculus macounii* - Uncommon. Beaver dam and sedge pond.

**Ranumculus natans* - Wet area near beaver lodge.

Ranunculus rhomboideus - Occasional. Grasslands.

Ranunculus sceleratus - Occasional. Marshy shores of willow swamps and ponds.

#*Thalictrum venulosum* - Fairly common. Aspen, balsam poplar and willow stands.

Fumariaceae

**Corydalis aurea* - Cleared field.

Cruciferae

Arabis hirsuta - Occasional. Grasslands and moist woods.

#*Arabis holboellii* var. *retrofracta* - Occasional. Grasslands and dunes.

Capsella bursa-pastoris - Balsam poplar stands by the spring, disturbed sites.

#*Cardamine pensylvanica* - Occasional. Moist and wet areas.

**Descurainia pinnata* - Disturbed area.

Descurainia richardsonii - Disturbed sites.

Descurainia sophia - Fairly common. Disturbed sites such as road sides and cow wallows.

**Diplotaxis muralis* - Dune areas.

Draba nemorosa var. *leiocarpa* - Occasional. Grasslands, moist sites and disturbed areas.

#*Erysimum asperum* - Fairly common. Dry grasslands and dunes.

#*Erysimum inconspicuum* - Fairly common. Blowouts and grasslands.

#*Lepidium densiflorum* - Uncommon. Grasslands and disturbed sites.

Lepidium ramosissimum - Saline meadow.

#*Lesquerella arenosa* - Disturbed grassy area.

**Physaria didymocarpa* - Cleared field.

Thlaspi arvense - Disturbed areas.

Droseraceae

#*Drosera anglica* - Fairly common. Fens with a wet *Drepanocladus* substrate.

Saxifragaceae

#*Heucheria richardsonii* - Occasional. Grasslands and dunes.

Mitella nuda - Occasional. Moist poplar and willow stands.

Parnassia montanensis - Rare. Ribstone fen.

#*Parnassia palustris* - Fairly common. Fens and moist woodlands.

#*Ribes americanum* - Occasional. Moist poplar and willow stands.

**Ribes hirtellum* - Moist aspen and willow groves.

Ribes hudsonianum - Uncommon. Moist poplar and willow stands.

#*Ribes oxyacanthoides* - Common. Moist woodlands, beaver dams and edges of ponds and spring.

Ribes triste - Occasional. Moist poplar and willow stands.

Rosaceae

#*Agrimonia striata* - Uncommon. Next to beaver ponds and in balsam groves.

#*Amelanchier alnifolia* - Fairly common in poplar stands; occasional in dry spots in fens and other moist areas.

#*Chamaerhodos erecta* ssp. *nuttallii* - Common. Grasslands and dunes.

#*Crataegus chrysocarpa* - Uncommon. Balsam and aspen poplar groves.

#*Fragaria virginiana* - Common. Most woodlands.

#*Geum allepicum* - Occasional. Moist poplar and willow groves.

#*Geum triflorum* - Fairly common. Grasslands.

#*Potentilla anserina* - Common. Wet meadows, grasslands, and lake, pond and dugout shorelines.

#*Potentilla arguta* - Occasional. Moist grasslands and shrubby areas.

Potentilla concinna - Uncommon. Grasslands.

#*Potentilla gracilis* var. *rigida* - Occasional. Grasslands and balsam poplar stands.

#_Potentilla hippiana_ - Fairly common. Grasslands.

Potentilla norvegica - Occasional. Wet meadows, willow stands and moist grasslands.

#_Potentilla palustris_ - Common in fens; occasional on pond edges.

#_Potentilla pensylvanica_ - Fairly common in grasslands; occasional in shrubs or aspen stands.

#_Potentilla rivalis_ - Uncommon. Wet meadow.

Prunus pensylvanica - Fairly common in aspen stands; occasional in interdune depressions.

#_Prunus virginiana_ - Common. Dunes and poplar and willow stands.

Rosa acicularis - Fairly common. Woodlands and shrubby areas of grasland.

Rosa arkansana - Fairly common. Grasslands and dune areas.

Rosa woodsii - Fairly common. Woodlands and grasslands.

#_Rubus pubescens_ - Common. Moist woodlands and moist hummocks in fens.

#_Rubus strigosus_ - Occasional. Moist poplar stands, open aspen stands, and edge of woodlands.

#_Spiraea alba_ - Fairly common. Throughout study area in dry aspen stands, open woodlands, balsam poplar stands, interdune depressions and grasslands.

Leguminosae

#_Astragalus agrestis_ - Occasional. Grasslands.

*_Astragalus canadensis_ - Uncommon. Edge of beaver pond.

Astragalus flexuosus - Occasional. Grasslands.

*_Astragalus frigidus_ var. _americanus_ - Uncommon. Edges of beaver ponds.

#_Astragalus striatus_ - Occasional. Grasslands.

Hedysarum alpinum var. _americanum_ - Occasional. Moist balsam poplar and willow woodlands and on shorelines of beaver ponds.

#_Lathyrus ochroleucus_ - Occasional. Moist poplar stands.

#_Medicago falcata_ - Cultivated fields and adjacent grasslands.

#*Medicago sativa* - Cultivated fields and adjacent grasslands.

**Melilotus alba* - Grasslands.

#*Melilotus officinallis* - Cultivated fields and disturbed areas.

#*Oxytropis campestris* - Occasional. Grasslands.

#*Oxytropis sericea* - Occasional. Grasslands.

#*Petalostemon purpureum* - Occasional. Grasslands.

#*Psoralea argophylla* - Occasional. Grasslands.

#*Thermopsis rhombifolia* - Fairly common. Grasslands and dry open aspen stands.

#*Vicia americana* - Fairly common. Moist poplar stands.

Vicia sparsifolia - Occasional. Grasslands.

Linaceae
#*Linum lewisii* - Uncommon. Grasslands.

Anacardiaceae
#*Rhus radicans* var. *rydbergii* - Occasional. Open aspen stands and on south slopes of dunes. Locally abundant.

Malvaceae
Sphaeralcea coccinea - Uncommon. Grasslands.

Cistaceae
Hudsonia tomentosa - Fairly common. Interdune depressions.

Violaceae
#*Viola adunca* - Fairly common. Poplar stands and grasslands.

Viola nephrophila - Fairly common. Fens on moist hummocks.

#*Viola rugulosa* - Occasional. Moist poplar and willow stands.

Cactaceae
#*Opuntia fragilis* - Uncommon in grasslands. Found mostly on the south slope of dunes.

Elaeagnaceae

#*Elaeagnus commutata* - Fairly common. Grasslands or open aspen stands.

#*Shepherdia canadensis* - Uncommon. Poplar and willow stands.

Onagraceae

#*Epilobium angustifolium* - Occasional. Moist woodlands.

#*Epilobium glandulosum* - Uncommon. Wet areas.

#*Epilobium leptophyllum* - Uncommon. Fens and wet areas.

**Epilobium palustre* - Uncommon. Fens.

Gaura coccinea - Occasional. Grasslands.

Oenothera biennis - Occasional. Grasslands and open aspen stands, especially in sandy areas.

#*Oenothera nuttallii* - Uncommon. Grasslands and cutlines, especially in sandy areas.

Halogragidaceae

#*Myriophyllum exalbescens* - Beaver ponds; aquatic.

Hippuridaceae

#*Hippuris vulgaris* - Beaver ponds; aquatic.

Araliaceae

#*Aralia nudicaulis* - Fairly common. Mature moist balsam poplar and willow stands.

Umbelliferae

Cicuta bulbifera - Occasional. Edges of beaver ponds and wet woodlands.

Cicuta douglasii - Sloping fen.

#*Heracleum lanatum* - Occasional. Wet areas.

#*Sanicula marilandica* - Uncommon. Moist balsam poplar and willow stands.

#*Sium suave* - Common. Wet willow stands and edge of beaver ponds and wet meadows.

#*Zizia aptera* - Occasional. Grasslands, open woodlands and moist sites next to beaver ponds.

Cornaceae

#Cornus canadensis - Uncommon. Moist poplar and willow stands.

#Cornus stolonifera - Fairly common in balsam and aspen poplar and willow stands. Occasional on hummocks in fens.

Pyrolaceae

#Pyrola asarifolia - Occasional. Moist woodlands.

#Pyrola elliptica - Occasional. Moist woodlands.

#Pyrola secunda - Uncommon. Moist woodlands and fens.

Ericaceae

#Arctostaphylos uva-ursi - Fairly common. Grasslands, open aspen stands and hummocks in fens.

Primulaceae

#Androsace septentrionalis - Uncommon. Grasslands.

#Dodecatheon radicatum - Uncommon. Moist areas.

#Glaux maritima - Fairly common. Moist saline grasslands or flats.

#Lysimachia ciliata - Occasional. Moist woodlands.

#Lysimachia thrysiflora - Occasional. Moist woodlands, fen strings and beaver pond edges.

#Primula incana - Uncommon. Moist grasslands and hummocks in fens.

Gentianaceae

Gentiana affinis - Rare. Balsam poplar and willow stands.

Gentiana fremontii - Rare. Hummocks in grasslands north of David Lake.

Gentianella amarella ssp. acuta - Uncommon. Grasslands, wet meadows and balsam poplar stands.

Gentianella crinata - Rare. Sloping fen.

#Menyanthes trifoliata - Common. Standing water and wet areas in fens.

Asclepiadaceae

#Asclepias ovalifolia - Uncommon. Open poplar stands.

Boraginaceae

Cryptantha fendleri - Rare. Sand dunes.

*_Cryptantha macounii_ - Dry aspen stands.

#_Hackelia americana_ - Fairly common. Disturbed areas.

Lappula redowskii var. _occidentalis_ - Common. Disturbed areas and moist sites.

#_Lithospermum incisum_ - Uncommon. Grasslands and disturbed areas.

Labiatae

#_Lycopus americanus_ - Uncommon. Wet areas.

#_Lycopus asper_ - Occasional. Wet areas.

#_Meutha arvensis_ var. _villosa_ - Fairly common. Moist woods, wet meadows and beaver pond edges.

#_Moldavica parviflora_ - Occasional. Cutlines and beaver pond edges.

Prunella vulgaris - Common in fens. Occasional on shores and in willow stands.

#_Scutellaria galericulata_ - Fairly common. Willow and balsam poplar stands, fens and pond edges.

#_Stachys palustris_ var. _pilosa_ - Occasional. Cutlines, aspen stands and damp areas.

Scrophulariaceae

#_Castilleja miniata_ - Rare. Willow stands and Wallaby Lake shore.

Orthocarpus luteus - Uncommon. Moist grasslands.

#_Pedicularis groenlandica_ - Fairly common. Fens.

*_Penstemon eriantherus_ - Rare. Grasslands.

Penstemon gracilis - Occasional. Moist grasslands.

Penstemon procerus - Occasional. Moist grasslands.

#_Veronica americana_ - Occasional. Wet areas such as fens, beaver dams and near the spring.

*_Veronica salina_ - Wet area near beaver lodge.

Veronica scutellata - Uncommon. Beaver dams and pond edges.

Orobanchaceae

Orobanche fasciculata - Rare. Interdune depressions.

Lentibulariaceae

Pinguicula vulgaris - Occasional. Fens on hummocks.

Utricularia intermedia - Fairly common. Small pools of water in fens.

#*Utricularia vulgaris* var. *americana* - Beaver ponds; aquatic submergent.

Plantaginaceae

Plantago major - Rare. Moist disturbed areas.

Rubiaceae

#*Galium boreale* - Common. Grasslands, dunes, open aspen stands and poplar and willow stands.

#*Galium trifidum* - Occasional. Wet areas on beaver dams and willow stands.

#*Galium triflorum* - Occasional. Balsam poplar and willow stands.

Caprifoliaceae

#*Linnaea borealis* var. *americana* - Occasional. Balsam poplar and willow stands.

#*Lonicera dioica* var. *glaucescens* - Aspen, balsam poplar and willow stands.

#*Symphoricarpos albus* - Occasional. Moist woodlands.

#*Symphoricarpos occidentalis* - Common. Grasslands, open poplar stands and some willow stands.

#*Viburnum edule* - Occasional. Moist balsam poplar and willow stands.

#*Viburnum trilobum* - Uncommon. Balsam poplar stands.

Campanulaceae

#*Campanula rotundifolia* - Fairly common. Grasslands and open aspen stands.

Lobeliaceae

#*Lobelia kalmii* - Occasional. Fens and David and Wallaby Lake shores.

Compositae

#Achillea millefolium - Common in grasslands; occasional in woodlands.

#Agoseris glauca var. agrestis - Uncommon. Grasslands.

#Antennaria nitida - Common. Dry grasslands.

#Antennaria pulcherrima - Uncommon. Fens.

Antennaria rosea - Occasional. Grasslands.

#Artemisia campestris - Fairly common. Grasslands.

#Artemisia frigida - Common. Grasslands.

#Artemisia ludoviciana - Common. Grasslands, open aspen stands and dunes.

#Aster ciliolatus - Fairly common. Moist woodlands.

#Aster junciformis - Fairly common in fens, wet meadows and shores; occasional in balsam poplar stands.

#Aster laevis var. geyeri - Common. Woodlands, buckbrush stands, hummocks in fens and grasslands.

#Aster pansus - Occasional. Moist grasslands and shores.

#Bidens cernua - Rare. Wet areas.

#Chrysopsis villosa var. hispida - Fairly common. Grasslands and open aspen stands.

Cirsium arvense - Occasional. Moist woodlands and disturbed areas.

Cirsium flodmanii - Uncommon. Grasslands, woodlands and shores.

*Cirsium foliosum - Rare. Meadows.

*Cirsium undulatum - Disturbed areas.

#Cirsium vulgare - Rare. Disturbed areas.

#Crepis runcinata - Fairly common. Wet meadows, saline meadows, shorelines, hummocks in fens, balsam poplar stands and disturbed sites.

#Crepis tectorum - Fairly common. Grasslands, interdune depressions, shrubby areas, aspen and willow stands and pond edges.

#Erigeron caespitosus - Uncommon. Grasslands.

Erigeron glabellus var. pubescens - Occasional. Grasslands, interdune depressions and shores.

#Erigeron philadelphicus - Occasional. Moist woodlands and shores.

Erigeron pumilus - Uncommon. Grasslands.

#Gaillardia aristata - Fairly common. Dry grasslands.

*Grindelia squarrosa - Rare.

*Haplopappus lanceolatus - Disturbed areas.

Helianthus annuus ssp. lenticularis - Rare. Grasslands.

#Helianthus laetiflorus var. subrhomboideus - Uncommon. Grasslands.

Helianthus nuttallii - Occasional. Grasslands.

*Hieracium canadense - Uncommon. Open woodlands.

Hieracium umbellatum - Rare. Moist sites.

#Lactuca pulchella - Occasional. Grasslands and open aspen stands.

*Liatris ligulistylis - Uncommon. Wet meadows.

#Lygodesmia juncea - Uncommon. Grasslands and dunes.

#Petasites palmatus - Uncommon. Balsam poplar and willow stands.

#Petasites sagittatus - Occasional. Moist balsam poplar and willow stands.

*Petasites vitifolius - Rare. Moist woodlands.

*Ratibida columnifera - Rare. Grasslands.

#Senecio canus - Occasional. Grasslands, interdune depressions and open dune aspen stands.

Senecio congestus var. palustris - Uncommon. Shores of Wallaby and David Lakes.

Senecio indecorus - Uncommon. Saline meadows.

Senecio pauperculus - Fairly common. Grasslands, wet meadows, balsam poplar stands, fens and on shores.

#Solidago decumbens var. oreophila - Fairly common. Grasslands, dunes and buckbrush stands.

*Solidago gigantea - Uncommon. Sand dunes.

Solidago lepida - Fairly common. Throughout study area including grasslands, balsam poplar and willow stands, shores, fens and wet meadows.

#Solidago missouriensis - Fairly common. Grasslands and dunes.

Solidago nemoralis var. decemflora - Fairly common. Dry grasslands, interdune grasslands and stable blowouts.

*Solidago pruinosa - Dune areas.

Solidago rigida - Uncommon. Grasslands.

Sonchus asper - Balsam poplar stand.

#Sonchus uliginosus - Disturbed areas.

Taraxacum officinale - Fairly common. Moist areas such as fen hummocks and balsam poplar stands.

Tragopogon dubius - Occasional. Grasslands.

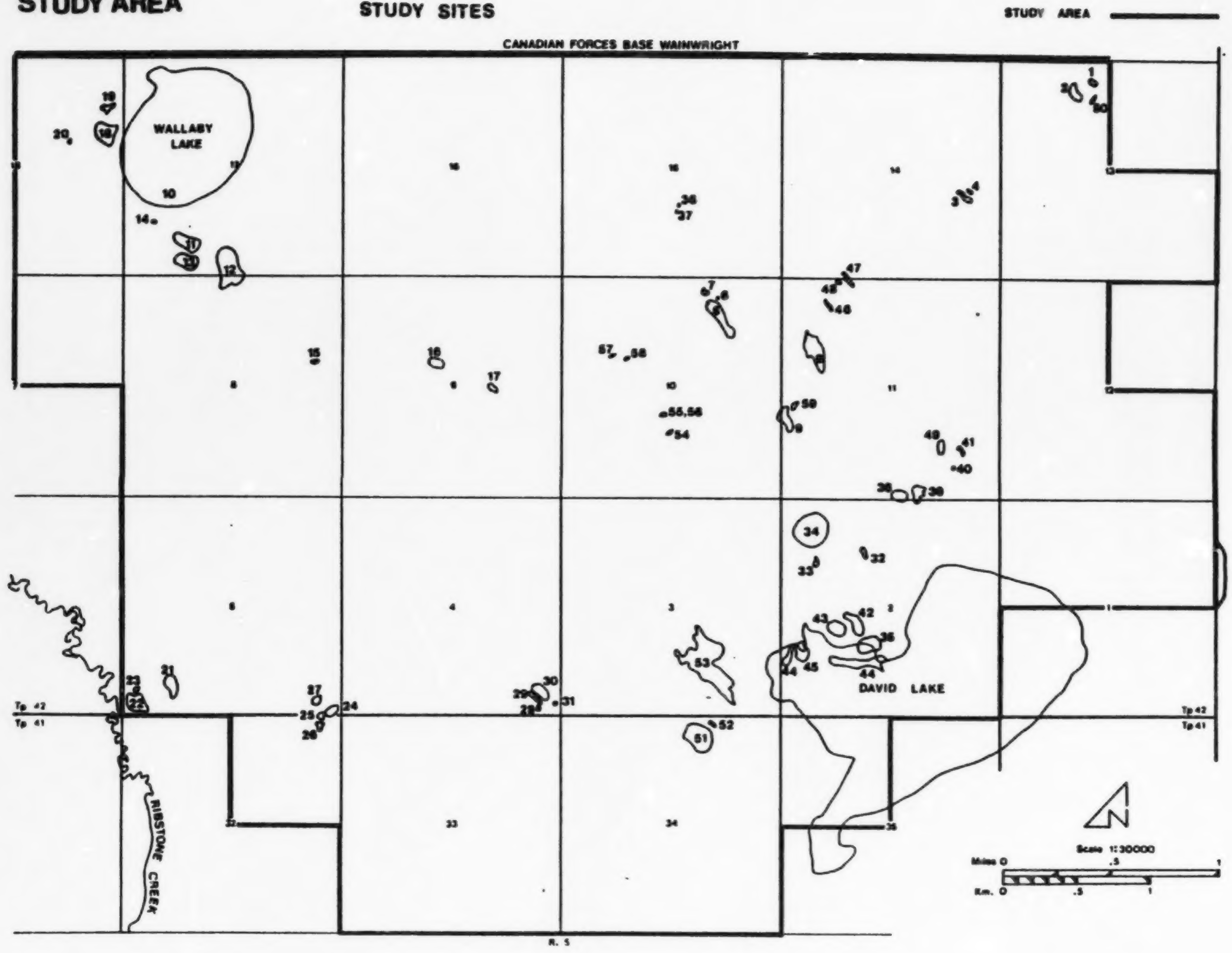
# Recorded by both Bradley and Bradley (1977) and the author.

* Recorded by Bradley and Bradley (1977).

APPENDIX 6

WAINWRIGHT STUDY AREA

STUDY SITES


STUDY AREA
CANADIAN FORCES BASE WAINWRIGHT
WALLABY LAKE
DAVID LAKE
RIBSTONE CREEK
Tp 42
Tp 41
R. 5
Scale 1:30000
Miles 0 .5 1
Km. 0 .5 1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55,56 57 58 59

APPENDIX 7

VEGETATION STAND TABLES

VEGETATION STAND TABLE

NATURAL AREAS PROGRAM--ALBERTA ENERGY AND NATURAL RESOURCES

THIS TABLE CONTAINS 360 SPECIES IN 59 PLOTS

VEGETATION PLOT NUMBER	AF83 001	AF83 002	AF83 003	AF83 004	AF83 005	AF83 006	AF83 007	AF83 008	AF83 009	AF83 010	AF83 011	AF83 012	AF83 013	AF83 014	AF83 015	AF83 016	AF83 017	AF83 018	AF83 019	AF83 020
PROJECT IDENTIFICATION	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN
LEGAL	WR 134 25W4	WR 134 25W4	WR 144 25W4	WR 144 25W4	WR 104 25W4	WR 104 25W4	WR 104 25W4	WR 114 25W4	WR 104 25W4	WR 174 25W4	WR 174 25W4	WR 174 25W4	WR 174 25W4	WR 174 25W4	WR 084 25W4	WR 094 25W4	WR 094 25W4	WR 184 25W4	WR 184 25W4	WR 184 25W4
BIOGEOGRAPHICAL ZONE	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
IBP CODE	1M2	1A2	1K2	3C2	1G2	1B2	1B2	1B2	1G2	1K2	1M2	1M2	1J2	102	102	1K2	3C2	1A2	1M2	1B2
VEGETATION TYPE	1	1	1	1	1	1A	1A	1A	1	1	1	1	1	2	2	1	1	1	2	1A
LANDFORM	MLII	MSLI	ESLI	ESIE	NMZ	LCRI	LCRI	ESLI	NMGZ	FSII	FSUI	FSUI	ESII	FSID	FPID	ESRI	ESIE	FSUI	FSLI	FSII
ELEVATION (M)																				
SLOPE (DEGREES)	20	00	01	03	02	00	00	01	.5	00	00	01	03	02	00	01	45	00	00	02
ASPECT	SW	00	W	S	SE	00	00	SE	S	00	00	N	SE	S	00	NW	SW	00	00	SE
SOIL	DBC	DBC	OR	OR	MO			G	MO		DBC	DBC	DBC	OR	R	OR	OR			DBC
MOISTURE REGIME	3	5	1	1	7	6	5	6	8	7	2	2	4	1	2	3	1	5	7	3
DRAINAGE	2	3	1	1	6	5	4	5	5	5	2	2	2	1	2	2	1	3	5	2
SITE POSITION	3	6	5	3	6	7	7	6	6	6	1	1	4	6	6	6	6	7	6	4
STABILITY INDEX	5	4	5	5	5	5	4	5	5	5	5	5	4	4	4	5	4	5	5	5
MICROTOPOGRAPHY	1	2	1	1	2	6	6	3	5	2	1	2	2	1	1	2	1	2	3	1
ROCK	.1	00	00	00	00	00	00	00	00	00	00	.1	00	00	01	00	00	.1	00	00
HUMUS	35	95	01	01	90	70	90	80	80	45	30	15	90	30	10	60	05	90	95	85
MINERAL SOIL	05	00	30	80	01	00	01	05	01	40	05	30	00	55	40	10	90	03	05	10
DEAD FALL	00	15	01	01	10	30	30	30	03	05	00	00	10	05	01	10	03	10	00	05
WATER	00	00	00	00	05	00	01	05	01	10	00	00	00	00	00	00	00	00	00	00
TOTAL UNVEGETATED	15	15	25	70	05	10	10	05	05	40	10	35	30	50	30	15	80	30	20	30
TREE CANOPY I	00	40	00	00	00	00	05	00	00	00	00	00	50	00	00	00	00	70	00	00
TREE CANOPY II	00	60	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
SHRUB CANOPY I	00	25	00	00	00	75	70	70	00	00	00	00	00	00	00	05	00	00	00	00
SHRUB CANOPY II	00	85	20	00	40	00	30	01	50	20	00	00	20	00	00	30	01	20	03	75
HERB-DWARF SHRUB	75	60	20	25	80	45	70	60	80	70	70	40	50	55	40	65	30	70	70	70
BRYOID	03	02	45	.5	70	30	05	05	40	10	65	60	02	50	60	55	00	.1	00	00

LAYER NUMBER 1: TREE CANOPY I 3 SPECIES

Populus balsamifera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Populus tremuloides	--	40	--	--	--	--	03	--	--	--	--	--	50	--	--	--	--	70	--	--
Salix planifolia	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	00	40	00	00	00	00	05	00	00	00	00	00	50	00	00	00	00	70	00	00

LAYER NUMBER 2: TREE CANOPY II 2 SPECIES

VEGETATION PLOT NUMBER	AF83 001	AF83 002	AF83 003	AF83 004	AF83 005	AF83 006	AF83 007	AF83 008	AF83 009	AF83 010	AF83 011	AF83 012	AF83 013	AF83 014	AF83 015	AF83 016	AF83 017	AF83 018	AF83 019	AF83 020
Populus tremuloides	--	55	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix bebbiana	--	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	00	60	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

LAYER NUMBER 3: SHRUB CANOPY I 15 SPECIES

VEGETATION PLOT NUMBER	AF83 001	AF83 002	AF83 003	AF83 004	AF83 005	AF83 006	AF83 007	AF83 008	AF83 009	AF83 010	AF83 011	AF83 012	AF83 013	AF83 014	AF83 015	AF83 016	AF83 017	AF83 018	AF83 019	AF83 020
Amelanchier alnifolia	--	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Betula pumila	--	--	--	--	--	50	45	--	--	--	--	--	--	--	--	--	--	--	--	--
Cornus stolonifera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elaeagnus commutata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Populus tremuloides	--	05	--	--	--	--	--	.1	--	--	--	--	--	--	--	05	--	--	--	--
Prunus virginiana	--	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix maccalliana	--	--	--	--	--	17	15	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix myrtillifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix pedicellaris	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix petiolaris	--	--	--	--	--	--	20	45	-	--	--	--	--	--	--	--	--	--	--	--
Salix planifolia	--	--	--	--	--	18	--	35	--	--	--	--	--	--	--	--	--	--	--	--
Salix pseudomonticola	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix serissima	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix sp.	--	--	--	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Viburnum trilobum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	00	25	00	00	00	75	70	70	00	00	00	00	00	00	00	05	00	00	00	00

LAYER NUMBER 4: SHRUB CANOPY II 31 SPECIES

VEGETATION PLOT NUMBER	AF83 001	AF83 002	AF83 003	AF83 004	AF83 005	AF83 006	AF83 007	AF83 008	AF83 009	AF83 010	AF83 011	AF83 012	AF83 013	AF83 014	AF83 015	AF83 016	AF83 017	AF83 018	AF83 019	AF83 020
Actaea rubra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Amelanchier alnifolia	--	15	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	01	--	--
Betula papyrifera	--	--	03	--	--	--	--	.5	--	02	--	--	--	--	--	02	--	--	--	--
Betula pumila	--	--	--	--	20	--	28	--	45	--	--	--	--	--	--	--	--	--	--	--
Cornus stolonifera	--	10	--	--	--	--	02	.1	--	--	--	--	--	--	--	--	--	--	--	--
Corylus cornuta	--	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elaeagnus commutata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lonicera dioica	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lonicera sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Populus balsamifera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	.5	--
Populus tremuloides	--	--	15	--	--	--	--	--	--	--	--	--	10	--	--	25	--	05	.5	--
Prunus pensylvanica	--	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Prunus virginiana	--	--	--	--	--	--	--	--	--	--	--	--	05	--	--	--	01	.5	--	--
Ribes americanum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ribes oxyacanthoides	--	05	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	02	--	--
Rosa acicularis	--	25	01	--	--	--	--	--	--	--	--	--	05	--	--	--	--	07	--	--
Rosa woodsii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.5	05
Rubus strigosus	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--
Salix bebbiana	--	--	01	--	--	--	--	--	--	01	--	--	--	--	--	03	--	--	.5	--
Salix candida	--	--	--	--	01	--	--	--	05	03	--	--	--	--	--	--	--	--	--	--
Salix pedicellaris	--	--	--	--	10	--	--	--	07	--	--	--	--	--	--	--	--	--	--	--
Salix petiolaris	--	--	--	--	07	--	--	--	--	05	--	--	--	--	--	--	--	--	.5	--
Salix planifolia	--	--	--	--	03	--	--	--	--	10	--	--	--	--	--	--	--	--	.5	--
Salix pseudomonticola	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix serissima	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--	--
Salix sp.	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--
Shepherdia canadensis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Spiraea alba	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	07	--	--
Symphoricarpos albus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--
Symphoricarpos occidentalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75
Viburnum edule	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	00	85	20	00	40	00	30	01	50	20	00	00	20	00	00	30	01	20	03	75

LAYER NUMBER 5: HERB-DWARF SHRUB 288 SPECIES

VEGETATION PLOT NUMBER	AF83 001	AF83 002	AF83 003	AF83 004	AF83 005	AF83 006	AF83 007	AF83 008	AF83 009	AF83 010	AF83 011	AF83 012	AF83 013	AF83 014	AF83 015	AF83 016	AF83 017	AF83 018	AF83 019	AF83 020
Achillea millefolium	--	--	.1	--	--	--	--	01	--	--	--	01	03	--	--	.1	--	02	--	05
Actaea rubra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agoseris glauca	--	--	--	--	--	--	--	--	--	--	.1	.1	--	--	--	--	--	--	--	--
Agropyron dasystachyum	--	--	--	--	--	--	--	--	--	--	--	--	05	--	--	02	--	--	--	--
Agropyron repens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron smithii	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	02	--	10
Agropyron subsecundum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	03	--
Agropyron trachycaulum	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agrostis scabra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Alopecurus aequalis	--	--	--	--	--	--	--	03	--	03	--	--	--	--	--	--	--	--	--	--
Androsace septentrionalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anemone canadensis	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anemone patens	01	--	--	--	--	--	--	--	--	--	03	01	--	--	--	--	--	--	--	--
Anemone sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--
Antennaria nitida	20	--	--	--	--	--	--	--	--	03	05	05	--	--	--	--	--	--	--	--
Antennaria pulcherrima	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Antennaria rosea	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--
Arabis holboellii	--	--	--	--	--	--	--	--	--	--	.1	.1	--	--	--	--	--	--	--	--
Aralia nudicaulis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arctostaphylos uva-ursi	--	--	05	05	--	--	01	--	--	--	01	03	--	--	05	05	--	01	--	--
Arenaria lateriflora	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Artemisia campestris	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	--	--	01	--	--	--
Artemisia frigida	25	--	--	--	--	--	--	--	--	--	10	25	--	--	--	--	--	.1	--	--
Artemisia longifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	05
Artemisia ludoviciana	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--	--	--	03	--	--
Aster ciliolatus	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--
Aster junciformis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1	--
Aster laevis	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--
Aster pansus	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--
Aster sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Astragalus flexuosus	08	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Astragalus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Astragalus striatus	01	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--
Beckmannia syzigachne	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Betula pumila	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bidens cernua	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bouteloua gracilis	10	--	--	--	--	--	--	--	--	--	01	02	--	01	--	--	--	--	--	--
Bromus anomalus	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromus ciliatus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromus inermis	--	--	--	--	--	--	--	--	--	--	--	15	--	--	--	--	--	03	--	--
Calamagrostis canadensis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calamagrostis inexpansa	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	10	--
Calamagrostis sp.	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calamovilfa longifolia	--	--	--	--	--	--	--	--	--	--	10	10	--	15	10	10	10	--	--	--
Campanula rotundifolia	--	--	--	--	--	--	--	--	--	--	--	.1	.1	--	--	--	--	01	--	--
Cardamine pensylvanica	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--
Carex aquatilis	--	--	--	--	25	--	02	--	25	--	--	--	--	--	--	--	--	--	--	--
Carex aurea	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--
Carex canescens	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--	--	--	--	--
Carex capillaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex crawfordii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Carex disperma	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex eleocharis	25	--	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--
Carex foenea	--	01	01	02	--	--	--	--	--	--	--	--	25	07	03	--	--	20	--	--
Carex heliophila	--	--	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex interior	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	02	--	--
Carex lasiocarpa	--	--	--	--	15	--	--	--	05	20	--	--	--	--	--	--	--	--	--	--
Carex limosa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex livida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex obtusata	--	--	--	02	--	--	--	--	--	--	--	--	--	03	01	05	.1	--	--	--
Carex parryana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex praegracilis	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--
Carex prairea	--	--	--	--	--	--	30	--	35	--	--	--	--	--	--	--	--	--	--	--
Carex rostrata	--	--	--	--	25	--	--	05	10	03	--	--	--	--	--	--	--	--	10	--
Carex sartwellii	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--
Carex sp.	--	--	--	--	--	35	--	--	--	--	05	--	--	--	01	--	--	--	25	20
Carex sprengelii	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--
Carex vaginata	--	--	--	--	--	--	30	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex viridula	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--
Castilleja miniata	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--
Castilleja sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cerastium arvense	--	--	--	--	--	--	--	--	--	--	03	03	--	--	--	--	--	.1	--	--
Chamaerhodos erecta	--	--	--	--	--	--	--	--	--	--	.5	05	--	01	.5	--	--	--	--	--
Chrysopsis villosa	.1	--	--	--	--	--	--	--	--	--	.5	01	--	--	--	--	.5	--	--	--
Cicuta douglasii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cirsium arvense	--	--	--	--	--	--	--	01	--	03	--	--	--	--	--	--	--	--	--	--
Cirsium flodmanii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cirsium vulgare	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--
Commandra pallida	03	--	--	--	--	--	--	--	--	--	05	--	03	--	--	01	--	--	--	--
Cornus canadensis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cornus stolonifera	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--
Corralorhiza trifida	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	--
Crepis runcinata	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	05	--
Crepis sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Crepis tectorum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cryptantha fendleri	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--
Cyperus schweinitzii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	--	--	--
Cypripedium calceolus	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--
Danthonia intermedia	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Deschampsia caespitosa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Descurainia sophia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Disporum trachycarpum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Distichlis stricta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Draba nemorosa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
[illegible]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
[illegible]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eleocharis acicularis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eleocharis compressa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eleocharis palustris	--	--	--	--	01	--	--	01	--	20	--	--	--	--	--	--	--	--	--	--
Elymus canadensis	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	05	--	--	--
Epilobium angustifolium	--	--	--	--	--	02	03	05	--	--	--	--	--	--	--	--	--	--	--	--
Epilobium leptophyllum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Equisetum arvense	--	--	--	--	--	--	--	.1	--	01	--	--	--	--	--	--	--	--	--	--
Equisetum fluviatile	--	--	--	--	.5	--	--	.1	01	--	--	--	--	--	--	--	--	--	--	--
Equisetum hyemale	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	02	--	.5	--	01
Equisetum palustre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Equisetum variegatum	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--
Erigeron caespitosus	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Erigeron glabellus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Erigeron philadelphicus	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--
Eriophorum angustifolium	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--

Eriophorum chamissonis	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eriophorum viridi-carinatum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Erysimum asperum	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Erysimum inconspicuum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--
Erysimum sp.	.1	--	--	--	--	--	--	--	--	--	--	.1	--	--	.1	--	.5	--	--	--
Festuca saximontana	--	--	01	01	--	--	--	--	--	--	05	10	--	10	05	--	01	--	--	--
Festuca scabrella	05	--	--	--	--	--	--	--	--	--	10	10	--	.1	--	--	--	--	--	--
Fragaria virginiana	--	01	--	--	--	--	02	05	--	.5	--	--	01	--	--	--	--	02	--	--
Gaillardia aristata	01	--	--	--	--	--	--	--	--	--	.5	.5	--	--	--	--	--	--	--	--
Galium boreale	--	03	--	--	--	--	--	--	01	--	--	--	03	--	--	01	--	10	--	10
Galium trifidum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Galium triflorum	--	--	--	--	--	.1	--	.5	--	--	--	--	--	--	--	--	--	--	--	--
Gaura coccinea	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gentiana amarella	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1	--
Gentiana crinata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Geranium richardsonii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Geum allepicum	--	.1	--	--	--	02	--	01	--	--	--	--	--	--	--	--	--	--	--	--
Geum triflorum	--	--	--	--	--	--	--	--	--	--	01	03	--	--	--	--	--	--	--	--
Glaux maritima	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.5	--
Glyceria borealis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Glyceria grandis	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--	--
Glyceria striata	--	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--
Grass sp.	--	--	--	--	--	--	--	10	--	--	--	--	01	--	--	--	--	--	--	--
Habenaria dilatata	--	--	--	--	--	--	--	--	0:	--	--	--	--	--	--	--	--	--	--	--
Habenaria hyperborea	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--
Habenaria viridis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hackelia americana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hackelia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Helictotrichon hookeri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heuchera richardsonii	--	--	.5	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--
Hordeum jubatum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	--
Hudsonia tomentosa	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	25	--	--	--	--	--
Juncus alpinus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Juncus balticus	--	--	.5	--	--	--	--	--	03	10	--	--	--	--	--	03	--	02	20	05
Juncus longistylis	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--
Juncus nodosus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Juncus tenuis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Juniperus communis	--	--	01	--	--	--	--	--	--	--	--	--	--	--	.5	05	--	--	--	--
Juniperus horizontalis	--	--	10	15	--	--	--	--	--	--	03	03	05	15	05	30	--	05	--	--
Koeleria cristata	20	--	--	.5	--	--	--	--	--	--	10	10	--	02	01	--	05	.5	--	10
Lappula redowski	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--
Lathyrus ochroleucus	--	03	--	--	--	--	--	.1	--	--	--	--	05	--	--	--	--	03	--	--
Lepidium ramosissimum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lilium philadelphicum	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--
Linnaea borealis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lobelia kalmii	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--
Lonicera dioica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lycopus americanus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lycopus asper	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lycopus sp.	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--
Lycopus uniflorus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lysimachia ciliata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lysimachia thyrsiflora	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Maianthemum canadense	--	01	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	.5	--	--
Mentha arvensis	--	--	--	--	--	--	--	03	--	03	--	--	--	--	--	--	--	--	--	--
Menyanthes trifoliata	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--
Mirabilis hirsuta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mitella nuda	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moldavica parviflora	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Muhlenbergia glomerata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oenothera biennis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Opuntia fragilis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Orthocarpus luteus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oryzopsis asperifolia	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--
Oryzopsis hymenoides	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--	--
Oryzopsis pungens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oxytropis campestris	08	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oxytropis sericea	.1	--	--	--	--	--	--	--	--	--	.5	.5	--	--	--	--	--	--	--	--
Parnassia montanensis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parnassia palustris	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--
Pedicularis groenlandica	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--
Penstemon gracilis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petasites sagittatus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phleum pratense	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phlox hoodii	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	01
Pinguicula vulgaris	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--
Plantago major	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Poa arida	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--
Poa interior	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	07
Poa palustris	--	--	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--	--	--
Poa pratensis	--	--	--	--	--	--	--	--	--	05	.1	--	--	--	--	--	--	10	18	08
Poa sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polygonum amphibium	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--
Populus tremuloides	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla anserina	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	05	--
Potentilla arguta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla concinna	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--
Potentilla gracilis	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--
Potentilla hippiana	01	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--
Potentilla norvegica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla palustris	--	--	--	--	01	--	--	--	02	--	--	--	--	--	--	--	--	--	--	--
Potentilla pensylvanica	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla rivalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	--	--
Primula incana	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--
Prunella vulgaris	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--
Prunus virginiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--
Psoralea agrophylla	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Puccinellia nuttalliana	--	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--
Pyrola asarifolia	--	03	--	--	--	05	05	.1	--	--	--	--	--	--	--	--	--	02	--	--
Pyrola elliptica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrola secunda	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ranunculus cymbalaria	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--
Ranunculus gmelinii	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--	--
Ranunculus sp.	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhus radicans	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ribes oxyacanthoides	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ribes triste	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rosa acicularis	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--
Rosa arkansana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rosa sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rosa woodsii	--	--	--	--	--	--	--	--	--	--	03	05	--	01	.5	.5	--	--	--	--
Rubus pubescens	--	03	--	--	--	05	05	05	--	--	--	--	--	--	--	--	--	--	--	--
Rubus strigosus	--	--	--	--	--	--	01	.1	--	--	--	--	--	--	--	--	--	--	--	--
Rumex occidentalis	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salicornia aristata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salicornia rubra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix bebbiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix candida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Salix pedicellaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix serissima	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix sp.	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--
Sanicula marilandica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Schizachne purpurascens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--
Scirpus acutus	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--
Scirpus americanus	--	--	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--	--	--
Scirpus caespitosus	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--
Scirpus validus	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--
Scolochloa festucacea	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--	--	--	--	--
Scutellaria galericulata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selaginella densa	20	--	05	--	--	--	--	--	--	--	30	30	--	15	--	10	--	--	--	--
Senecio canus	--	--	--	--	--	--	--	--	--	--	.1	.1	.1	--	--	--	--	--	--	--
Senecio congestus	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--
Senecio lugens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Senecio pauperculus	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--
Sisyrinchium montanum	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--
Sium suave	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--
Smilacina stellata	--	.1	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	01	--	--
Solidago decumbens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solidago lepida	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	02	--
Solidago missouriensis	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solidago nemoralis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solidago rigida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solidago sp.	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	.1	01	--	--	--	--
Sonchus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sparganium minimum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sphaeralcea coccinea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Spiraea alba	--	--	02	--	--	--	--	--	--	--	--	--	--	--	--	10	--	--	--	--
Stachys palustris	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--	--
Stellaria longifolia	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--	--
Stellaria longipes	--	02	.1	--	01	--	--	--	--	03	--	--	--	--	--	.1	--	01	--	--
Stellaria sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stipa comata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stipa spartea	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Suaeda depressa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Symphoricarpos albus	--	10	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--
Symphoricarpos occidentalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Taraxacum officinale	--	01	--	--	--	--	--	.5	.5	01	--	--	--	--	--	--	--	--	--	--
Thalictrum venulosum	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	02	--	--
Thermopsis rhombifolia	15	--	--	--	--	--	--	--	--	--	03	--	03	--	--	.5	--	25	--	--
Tofieldia glutinosa	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--
Tragopogon dubius	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Triglochin maritima	--	--	--	--	.1	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--
Triglochin palustris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Typha latifolia	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--
Urtica gracilis	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--
Utricularia intermedia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vicia americana	--	02	--	--	--	--	--	.1	--	--	--	--	.5	--	--	--	--	01	--	--
Vicia sparsifolia	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Viola adunca	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	01	--	--
Viola nephrophila	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--
Viola rugulosa	--	03	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Zizia aptera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zygadenus elegans	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--
TOTAL	75	60	20	25	80	45	70	60	80	70	70	40	50	55	40	65	30	70	70	70

LAYER NUMBER 6: BRYOID 56 SPECIES

VEGETATION PLOT NUMBER	AF83 001	AF83 002	AF83 003	AF83 004	AF83 005	AF83 006	AF83 007	AF83 008	AF83 009	AF83 010	AF83 011	AF83 012	AF83 013	AF83 014	AF83 015	AF83 016	AF83 017	AF83 018	AF83 019	AF83 020
Amblystegium serpens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Amblystegium varium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aulacomnium palustre	--	--	--	--	30	09	02	--	10	--	--	--	--	--	--	--	--	--	--	--
Brachythecium ellipticum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachythecium salebrosum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachythecium sp.	--	.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachythecium turgidum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bryum pseudotriquetrum	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calliergon giganteum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Campylium hispidulum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Campylium stellatum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ceratodon purpurea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cetraria ericetorum	--	.4	05	.5	--	--	--	--	--	--	05	01	--	03	03	--	--	--	--	--
Cetraria nivalis	.6	.4	10	--	--	--	--	--	--	--	03	01	--	--	03	03	--	--	--	--
Cladonia chlorophaea	.7	.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia coccifera	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia coniocraea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia incinatus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	08	--	--	--	--
Cladonia mitis	.7	--	30	--	--	--	--	--	--	--	10	01	02	10	50	35	--	--	--	--
Cladonia pyxidata	.8	.1	--	--	--	--	--	--	--	--	22	10	--	25	--	07	--	--	--	--
Cladonia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cornicularia aculeata	--	--	--	--	--	--	--	--	--	--	05	01	--	10	04	.2	--	--	--	--
Dicranum fuscescens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dicranum muehlenbeckii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dicranum sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drepanocladus aduncus	--	--	--	--	35	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drepanocladus exannulatus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drepanocladus revolvens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drepanocladus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Evernia mesomorpha	--	--	--	--	.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Helodium blandowii	--	--	--	--	--	12	--	--	20	--	--	--	--	--	--	--	--	--	--	--
Hypnum cupressiforme	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--
Leptobryum pyriforme	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--
Lichen spp	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Meesia triquetra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mosses	--	--	--	--	--	--	--	05	--	--	--	--	.1	--	--	--	--	--	--	--
Parmelia chlorochra	.2	--	--	--	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--
Parmelia septentrionalis	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Parmelia sulcata	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--
Parmeliopsis hyperopta	--	--	--	--	.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Peltigera rufescens	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Physcia aipolia	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Physcia orbicularis	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Physcia stellaris	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Physia adscendens	--	--	--	--	--	--	.1	--	--	--	--	--	.1	--	--	--	--	--	--	--
Plagiomnium ellipticum	--	--	--	--	--	09	--	--	05	--	--	--	--	--	--	--	--	--	--	--
Pohlia nutans	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--
Polytrichum juniperinum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polytrichum piliferum	--	--	--	--	--	--	--	--	--	--	20	15	--	--	--	--	--	--	--	--
Polytrichum sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pylaisiella polyantha	--	.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--
Splachnum ampullaceum	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--
Thuidium recognitum	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--

Tomenthypnum nitens	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--
Tortula ruralis	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xanthoria fallax	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	03	02	45	.5	70	30	05	05	40	10	65	60	02	50	60	55	00	.1	00	00

VEGETATION STAND TABLE

NATURAL AREAS PROGRAM--ALBERTA ENERGY AND NATURAL RESOURCES

THIS TABLE CONTAINS 360 SPECIES IN 59 PLOTS

VEGETATION PLOT NUMBER	AF83 021	AF83 022	AF83 023	AF83 024	AF83 025	AF83 026	AF83 027	AF83 028	AF83 029	AF83 030	AF83 031	AF83 032	AF83 033	AF83 034	AF83 035	AF83 036	AF83 037	AF83 038	AF83 039	AF83 040
PROJECT IDENTIFICATION	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN
LEGAL	WR 054 25W4	WR 054 25W4	WR 054 25W4	WR 54 25W4	WR 324 15W4	WR 324 15W4	WR 054 25W4	WR 044 25W4	WR 044 25W4	WR 044 25W4	WR 044 25W4	WR 024 25W4	WR 024 25W4	WR 024 25W4	WR 024 25W4	WR 154 25W4	WR 154 25W4	WR 114 25W4	WR 114 25W4	WR 114 25W4
BIOGEOGRAPHICAL ZONE	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
IBP CODE	1K2 1	1B2 1A	1A2 1	1A2 1	1A2 1	1M2 1	1M2 1	3C2 1	1J2 1	1K2 1	1H2 1	1B2 1A	1B2 1A	1M2 2	1M2 1	1O2 2	1O2 2	1A2 1	1G2 1	3C2 1
VEGETATION TYPE																				
LANDFORM	NMGZ	LCHI	ESUI	ESUI	ESUI	ESMI	ESUI	ESIE	ESSI	ESUI	ESIE	ESII	ESUI	ESLI	LSUI	ESIE	ESII	LSII	NMGC	ESIE
ELEVATION (M)																				
SLOPE (DEGREES)	00	00	01	00	03	05	00	10	45	00	03	02	02	00	00	15	00	10	15	30
ASPECT	00	00	SW	00	NE	E	00	SW	NE	00	S	N	NE	00	00	S	00	S	S	S
SOIL	MO		BC		DBC	DBC	DBC	OR		OR	OR	DBC	DBC		DBC	OR	OR	DGC	MO	OR
MOISTURE REGIME	8	6	5	4	3	3	2	1	3	2	2	4	3	8	2	2	3	5	8	1
DRAINAGE	5	4	3	3	2	2	2	1	2	2	2	2	2	5	2	1	2	3	5	1
SITE POSITION	6	6	5	7	4	4	7	3	3	7	6	3	7	6	7	4	6	4	4	3
STABILITY INDEX	5	5	5	5	4	5	5	5	5	5	4	5	5	5	5	4	4	5	5	4
MICROTOPOGRAPHY	4	4	2	1	2	1		1	1	2	1	1	2	2	2	1	1	2	2	1
ROCK	00	00	00	00	00	00	02	00	00	00	00	00	00	00	00	00	00	00	00	00
HUMUS	70	60	95	85	90	70	35	05	70	30	20	95	70	80	70	15	25	85	70	04
MINERAL SOIL	05	00	00	00	00	05	02	90	10	02	50	03	15	05	30	50	03	01	03	95
DEAD FALL	05	30	10	30	15	05	01	05	25	05	15	02	20	00	01	05	02	20	03	01
WATER	25	.5	00	00	00	00	00	00	00	00	00	00	00	20	00	00	00	00	15	00
TOTAL UNVEGETATED	30	20	20	20	30	15	10	80	05	05	40	15	01	25	20	35	20	15	05	95
TREE CANOPY I	00	00	70	55	75	00	00	00	15	00	00	00	00	00	00	00	00	65	00	00
TREE CANOPY II	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
SHRUB CANOPY I	00	60	10	50	00	00	00	00	40	00	00	00	40	00	00	00	30	15	00	00
SHRUB CANOPY II	30	70	60	40	20	20	00	00	60	20	00	80	80	00	00	00	15	70	35	00
HERB-DWARF SHRUB	85	50	70	70	50	80	70	25	60	50	60	80	50	90	70	35	30	75	90	10
BRYOID	25	20	.1	05	01	05	35	03	02	60	25	01	00	00	00	35	60	01	70	00

LAYER NUMBER 1: TREE CANOPY I 3 SPECIES

Populus balsamifera	--	--	55	--	--	--	--	--	--	--	--	--	--	--	--	--	--	65	--	--
Populus tremuloides	--	--	15	55	75	--	--	--	15	--	--	--	--	--	--	--	--	--	--	--
Salix planifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	00	00	70	55	75	00	00	00	15	00	00	00	00	00	00	00	00	65	00	00

LAYER NUMBER 2: TREE CANOPY II 2 SPECIES

VEGETATION PLOT NUMBER	AF83 021	AF83 022	AF83 023	AF83 024	AF83 025	AF83 026	AF83 027	AF83 028	AF83 029	AF83 030	AF83 031	AF83 032	AF83 033	AF83 034	AF83 035	AF83 036	AF83 037	AF83 038	AF83 039	AF83 040
Populus tremuloides	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix bebbiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

LAYER NUMBER 3: SHRUB CANOPY I 15 SPECIES

VEGETATION PLOT NUMBER	AF83 021	AF83 022	AF83 023	AF83 024	AF83 025	AF83 026	AF83 027	AF83 028	AF83 029	AF83 030	AF83 031	AF83 032	AF83 033	AF83 034	AF83 035	AF83 036	AF83 037	AF83 038	AF83 039	AF83 040
Amelanchier alnifolia	--	--	--	30	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--
Betula pumila	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cornus stolonifera	--	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elaeagnus commutata	--	--	--	--	--	--	--	--	--	--	--	--	40	--	--	--	--	--	--	--
Populus tremuloides	--	--	--	20	--	--	--	--	--	--	--	--	--	--	--	--	30	--	--	--
Prunus virginiana	--	--	--	--	--	--	--	--	35	--	--	--	--	--	--	--	--	05	--	--
Salix maccalliana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix myrtillifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix pedicellaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix petiolaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix planifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix pseudomonticola	--	--	09	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix serissima	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix sp.	--	50	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	05	--	--
Viburnum trilobum	--	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	07	--	--
TOTAL	00	60	10	50	00	00	00	00	40	00	00	00	40	00	00	00	30	15	00	00

LAYER NUMBER 4: SHRUB CANOPY II 31 SPECIES

VEGETATION PLOT NUMBER	AF83 021	AF83 022	AF83 023	AF83 024	AF83 025	AF83 026	AF83 027	AF83 028	AF83 029	AF83 030	AF83 031	AF83 032	AF83 033	AF83 034	AF83 035	AF83 036	AF83 037	AF83 038	AF83 039	AF83 040
Actaea rubra	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--
Amelanchier alnifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--
Betula papyrifera	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--
Betula pumila	25	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	25	--
Cornus stolonifera	01	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	03	--
Corylus cornuta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	--	--
Elaeagnus commutata	--	--	--	--	03	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lonicera dioica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lonicera sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Populus balsamifera	--	--	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Populus tremuloides	--	--	05	--	10	--	--	--	10	20	--	--	--	--	--	--	09	03	--	--
Prunus pensylvanica	--	--	--	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Prunus virginiana	--	--	--	--	05	--	--	--	45	--	--	02	--	--	--	--	--	--	--	--
Ribes americanum	--	15	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ribes oxyacanthoides	--	10	10	--	--	--	--	--	01	--	--	--	05	--	--	--	--	01	--	--
Rosa acicularis	--	15	10	10	05	--	--	--	05	05	--	--	--	--	--	--	--	07	--	--
Rosa woodsii	--	--	10	--	--	--	--	--	--	--	--	05	20	--	--	--	--	--	--	--
Rubus strigosus	--	02	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--	02	--	--
Salix bebbiana	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	06	--	--	--
Salix candida	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	07	--
Salix pedicellaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	05	--
Salix petiolaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix planifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix pseudomonticola	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--
Salix serissima	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix sp.	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Shepherdia canadensis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	02	--	--
Spiraea alba	--	--	--	--	--	--	--	--	15	--	--	--	--	--	--	--	--	--	--	--
Symphoricarpos albus	--	20	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	--	--
Symphoricarpos occidentalis	--	--	--	--	--	--	--	--	--	--	--	80	70	--	--	--	--	--	--	--
Viburnum edule	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	07	--	--
TOTAL	30	70	60	40	20	20	00	00	60	20	00	80	80	00	00	00	15	70	35	00

LAYER NUMBER 5: HERB-DWARF SHRUB 288 SPECIES

VEGETATION PLOT NUMBER	AF83 021	AF83 022	AF83 023	AF83 024	AF83 025	AF83 026	AF83 027	AF83 028	AF83 029	AF83 030	AF83 031	AF83 032	AF83 033	AF83 034	AF83 035	AF83 036	AF83 037	AF83 038	AF83 039	AF83 040
Achillea millefolium	--	--	.1	--	--	01	--	--	--	--	--	20	05	--	01	--	--	--	--	--
Actaea rubra	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agoseris glauca	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron dasystachyum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron repens	--	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron smithii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron sp.	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--	--
Agropyron subsecundum	--	--	--	--	--	03	--	--	01	--	--	05	01	--	--	--	--	--	--	--
Agropyron trachycaulum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agrostis scabra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Alopecurus aequalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Androsace septentrionalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--
Anemone canadensis	--	--	02	--	--	--	--	--	--	--	--	02	.1	--	.5	--	--	--	--	--
Anemone patens	--	--	--	--	--	01	.5	--	--	--	--	--	--	--	--	--	--	--	--	--
Anemone sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Antennaria nitida	--	--	--	--	--	04	02	--	--	--	--	01	--	--	35	--	--	--	--	--
Antennaria pulcherrima	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Antennaria rosea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arabis holboellii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aralia nudicaulis	--	15	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	30	--	--
Arctostaphylos uva-ursi	--	--	--	10	--	--	--	--	02	02	--	--	--	--	--	--	04	--	--	--
Arenaria lateriflora	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Artemisia campestris	--	--	--	--	--	01	05	--	--	02	--	--	--	--	--	--	.5	--	--	--
Artemisia frigida	--	--	--	--	--	10	07	--	--	05	--	--	--	--	20	--	--	--	--	--
Artemisia longifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Artemisia ludoviciana	--	--	--	--	01	04	03	.1	--	01	--	10	--	--	.5	--	--	--	--	--
Aster ciliolatus	--	--	05	--	--	--	--	--	--	--	--	--	.5	--	--	--	.1	05	--	--
Aster junciformis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aster laevis	01	--	--	05	.1	--	--	--	.5	--	--	06	--	--	--	--	01	--	--	--
Aster pansus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aster sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Astragalus sp.	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Beckmannia syzigachne	--	--	--	--	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--
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Bouteloua gracilis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Calamagrostis sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calamovilfa longifolia	--	--	--	--	--	--	20	02	--	20	15	--	--	--	--	--	--	--	--	--
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Danthonia intermedia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Festuca scabrella	--	--	--	--	--	25	05	--	--	--	--	.1	--	--	--	--	--	--	--	--
Fragaria virginiana	--	--	05	--	02	--	--	--	05	--	--	02	02	--	--	--	--	01	--	--
Gaillardia aristata	--	--	--	--	--	01	.5	--	--	--	--	--	--	--	--	--	--	--	--	--
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Habenaria hyperborea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.5	--
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Hackelia americana	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--
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Potentilla anserina	--	--	--	--	--	--	--	--	--	--	--	--	--	60	03	--	--	--	--	--
Potentilla arguta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla concinna	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla gracilis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla hippiana	--	--	--	--	--	.1	05	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla norvegica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla palustris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potentilla pensylvanica	--	--	--	--	--	--	.1	--	--	--	--	--	.5	--	02	--	--	--	--	--
Potentilla rivalis	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--
Potentilla sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Primula incana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Prunella vulgaris	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Prunus virginiana	--	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	01
Psoralea agrophylla	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Puccinellia nuttalliana	--	--	--	--	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--
Pyrola asarifolia	--	01	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	02	.5	--
Pyrola elliptica	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrola secunda	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.5	--
Ranunculus cymbalaria	01	--	--	--	--	--	--	--	--	--	--	--	--	05	--	--	--	--	01	--
Ranunculus gmelinii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ranunculus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhus radicans	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--	--
Ribes oxyacanthoides	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ribes triste	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	02	--	--
Rosa acicularis	--	--	--	--	--	15	05	--	--	--	--	--	--	--	--	--	02	--	--	--
Rosa arkansana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--
Rosa sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rosa woodsii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rubus pubescens	03	15	10	05	--	--	--	--	--	--	--	--	--	--	--	--	--	07	03	--
Rubus strigosus	--	--	--	--	--	--	--	--	.5	--	--	02	--	--	--	--	--	--	--	--
Rumex occidentalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salicornia aristata	--	--	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--
Salicornia rubra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix bebbiana	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--
Salix candida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Salix pedicellaris	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix serissima	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--
Sanicula marilandica	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--
Schizachne purpurascens	--	--	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Scirpus acutus	--	--	--	--	--	--	--	--	--	--	--	--	--	30	--	--	--	--	--	--
Scirpus americanus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Scirpus caespitosus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--
Scirpus validus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Scolochloa festucacea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Scutellaria galericulata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selaginella densa	--	--	--	--	--	15	30	--	--	15	.5	--	--	--	--	01	05	--	--	--
Senecio canus	--	--	--	--	--	.1	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Senecio congestus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Senecio lugens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Senecio pauperculus	01	--	.1	--	--	--	--	--	--	--	--	--	--	01	03	--	--	--	--	--
Sisyrinchium montanum	.1	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sium suave	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Smilacina stellata	--	--	01	03	02	--	--	--	07	--	--	--	--	--	--	--	--	03	--	--
Solidago decumbens	02	--	--	--	--	--	--	.5	--	--	--	.5	--	--	--	--	--	--	--	--
Solidago lepida	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--
Solidago missouriensis	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--
Solidago nemoralis	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	01	--	--	--
Solidago rigida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solidago sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sonchus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sparganium minimum	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sphaeralcea coccinea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Spiraea alba	--	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	03	--	--	--
Stachys palustris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stellaria longifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stellaria longipes	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stellaria sp.	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stipa comata	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--
Stipa spartea	--	--	--	--	--	20	--	--	--	--	--	05	01	--	--	--	--	--	--	--
Suaeda depressa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Symphoricarpos albus	--	--	--	25	--	--	--	--	20	--	--	--	--	--	--	--	--	--	--	--
Symphoricarpos occidentalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--
Taraxacum officinale	--	--	03	--	--	--	--	--	--	--	--	--	01	01	--	--	--	--	.5	--
Thalictrum venulosum	--	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	--	--
Thermopsis rhombifolia	--	--	--	10	03	07	--	--	--	--	--	.1	05	--	--	--	--	--	--	--
Tofieldia glutinosa	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--
Tragopogon dubius	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Triglochin maritima	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Triglochin palustris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	04	--
Typha latifolia	.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Urtica gracilis	--	--	--	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--
Utricularia intermedia	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vicia americana	--	--	10	05	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--
Vicia sparsifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Viola adunca	--	--	--	--	--	--	--	--	--	--	--	03	01	--	02	--	--	--	--	--
Viola nephrophila	05	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--
Viola rugulosa	--	01	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	02	--	--
Zizia aptera	02	.5	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zygadenus elegans	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	85	50	70	70	50	80	70	25	60	50	60	80	50	90	70	35	30	75	90	10

LAYER NUMBER 6: BRYOID 56 SPECIES

VEGETATION PLOT NUMBER	AF83 021	AF83 022	AF83 023	AF83 024	AF83 025	AF83 026	AF83 027	AF83 028	AF83 029	AF83 030	AF83 031	AF83 032	AF83 033	AF83 034	AF83 035	AF83 036	AF83 037	AF83 038	AF83 039	AF83 040
Amblystegium serpens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Amblystegium varium	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aulacomnium palustre	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachythecium ellipticum	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachythecium salebrosum	--	--	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--
Brachythecium sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachythecium turgidum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bryum pseudotriquetrum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	05	--
Calliergon giganteum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	05	--
Campylium hispidulum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Campylium stellatum	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	--
Ceratodon purpurea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cetraria ericetorum	--	--	--	--	--	--	02	01	--	--	05	--	--	--	--	05	03	--	--	--
Cetraria nivalis	--	--	--	--	--	--	03	01	--	02	--	--	--	--	--	--	05	--	--	--
Cladonia chlorophaea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--	--
Cladonia coccifera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia coniocraea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia incinatus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia mitis	--	--	--	--	.5	02	20	01	--	49	15	--	--	--	--	20	40	--	--	--
Cladonia pyxidata	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--	--	04	--	--	--
Cladonia sp.	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	--	--	--
Cornicularia aculeata	--	--	--	--	--	--	01	--	--	02	03	--	--	--	--	04	03	--	--	--
Dicranum fuscescens	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--
Dicranum muehlenbeckii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	05	--	--	--
Dicranum sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drepanocladus aduncus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drepanocladus exannulatus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drepanocladus revolvens	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	30	--
Drepanocladus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Evernia mesomorpha	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Helodium blandowii	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--
Hypnum cupressiforme	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Leptobryum pyriforme	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lichen spp	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Meesia triquetra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	--
Mosses	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parmelia chlorochra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--
Parmelia septentrionalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parmelia sulcata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parmeliopsis hyperopta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Peltigera rufescens	--	--	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--
Physcia aipolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Physcia orbicularis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Physcia stellaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Physia adscendens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Plagiomnium ellipticum	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	05	--
Pohlia nutans	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polytrichum juniperinum	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--	--
Polytrichum piliferum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polytrichum sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pylaisiella polyantha	--	02	.1	05	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Splachnum ampullaceum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--
Thuidium recognitum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Tomenthypnum nitens	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15	--
Tortula ruralis	--	--	--	--	--	--	--	.5	--	--	01	--	--	--	--	06	--	--	--	--
Xanthoria fallax	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	25	20	.1	05	01	05	35	03	02	60	25	01	00	00	00	35	60	01	70	00

V E G E T A T I O N   S T A N D   T A B L E

NATURAL AREAS PROGRAM--ALBERTA ENERGY AND NATURAL RESOURCES

THIS TABLE CONTAINS 360 SPECIES IN 59 PLOTS

VEGETATION PLOT NUMBER	AF83 041	AF83 042	AF83 043	AF83 044	AF83 045	AF83 046	AF83 047	AF83 048	AF83 049	AF83 050	AF83 051	AF83 052	AF83 053	AF83 054	AF83 055	AF83 056	AF83 057	AF83 058	AF83 059
PROJECT IDENTIFICATION	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN	WAIN
LEGAL	WR 114 25W4	WR 024 25W4	WR 024 25W4	WR 024 25W4	WR 024 25W4	WR 114 25W4	WR 114 25W4	WR 114 25W4	WR 114 25W4	WR 134 25W4	WR 344 15W4	WR 344 15W4	WR 034 25W4	WR 104 25W4	WR 104 25W4	WR 104 25W4	WR 104 25W4	WR 104 25W4	WR 114 25W4
BIOGEOGRAPHICAL ZONE	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
IBP CODE	1K2	1M2	1M2	1M2	1M2	1J2	1A2	1A2	1M2	1M2	1G2	1M2	1G2	101	101	1B2	101	1B2	1B2
VEGETATION TYPE	1	1	2	2	2	1	1	1	1	1	1	1	1	2	2	1A	2	1A	1A
LANDFORM	ESUI	LSLI	ESLI	LCLI	LCLI	ESRI	ESRI	ESUI	ESII	MSII	ESLI	ESII	FMZ	NMGZ	NMGZ	OM	NMGZ	OM	ESLI
ELEVATION (M)																			
SLOPE (DEGREES)	00	00	00	00	00	15	35	01	03	05	00	05	00	00	00	00	00	00	00
ASPECT	00	00	00	00	00	NE	NE	NW	N	SW	00	S	00	00	00	00	00	00	00
SOIL	OR	DBC				C	DBC	C	DBC	DBC		DBC	O	MO	MO	O	MO		
MOISTURE REGIME	2	3	7	7	7	2	2	3	2	3	8	2	7	8	8	7	9	7	7
DRAINAGE	2	3	5	5	5	1	1	2	2	3	5	1	5	6	6	5	6	5	5
SITE POSITION	6	7	6	6	6	3	3	7	4	4	6	3	7	6	6	1	6	6	6
STABILITY INDEX	5	5	5	5	5	4	5	4	5	5	5	5	5	5	5	5	5	5	5
MICROTOPOGRAPHY	1	2	2	2	2	2	2	2	2	2	2	1	4	3	2	4	2	3	4
ROCK	00	03	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
HUMUS	35	60	70	30	80	80	85	65	25	50	85	60	25	50	70	65	40	60	80
MINERAL SOIL	25	20	01	65	03	05	02	01	05	01	02	05	00	01	00	01	01	01	05
DEAD FALL	05	00	.5	.5	02	10	15	10	02	01	'03	.5	01	05	02	10	02	10	25
WATER	00	00	40	01	15	00	00	00	00	00	10	00	00	05	05	00	30	01	00
TOTAL UNVEGETATED	30	30	40	40	10	05	01	05	08	05	10	20	05	05	08	05	20	05	05
TREE CANOPY I	00	00	00	00	00	40	70	50	00	00	00	00	00	00	00	00	00	00	00
TREE CANOPY II	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
SHRUB CANOPY I	00	00	00	00	00	00	00	00	00	00	30	00	60	00	00	00	00	00	85
SHRUB CANOPY II	25	00	02	00	05	40	30	10	00	00	00	00	35	20	05	70	02	60	20
HERB-DWARF SHRUB	25	70	95	60	95	40	40	60	70	80	75	45	30	40	60	50	70	40	25
BRYOID	30	00	05	00	00	.5	.2	.3	07	00	00	10	75	80	70	60	60	50	20

LAYER NUMBER 1: TREE CANOPY I 3 SPECIES

Populus balsamifera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Populus tremuloides	--	--	--	--	--	40	70	50	--	--	--	--	--	--	--	--	--	--	--
Salix planifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	00	00	00	00	00	40	70	50	00	00	00	00	00	00	00	00	00	00	00

LAYER NUMBER 2: TREE CANOPY II 2 SPECIES

VEGETATION PLOT NUMBER	AF83 041	AF83 042	AF83 043	AF83 044	AF83 045	AF83 046	AF83 047	AF83 048	AF83 049	AF83 050	AF83 051	AF83 052	AF83 053	AF83 054	AF83 055	AF83 056	AF83 057	AF83 058	AF83 059
Populus tremuloides	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix bebbiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

LAYER NUMBER 3: SHRUB CANOPY I 15 SPECIES

VEGETATION PLOT NUMBER	AF83 041	AF83 042	AF83 043	AF83 044	AF83 045	AF83 046	AF83 047	AF83 048	AF83 049	AF83 050	AF83 051	AF83 052	AF83 053	AF83 054	AF83 055	AF83 056	AF83 057	AF83 058	AF83 059
Amelanchier alnifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Betula pumila	--	--	--	--	--	--	--	--	--	--	--	--	60	--	--	--	--	--	30
Cornus stolonifera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elaeagnus commutata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Populus tremuloides	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Prunus virginiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix maccalliana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix myrtillifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75
Salix pedicellaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix petiolaris	--	--	--	--	--	--	--	--	--	--	25	--	--	--	--	--	--	--	--
Salix planifolia	--	--	--	--	--	--	--	--	--	--	04	--	01	--	--	--	--	--	--
Salix pseudomonticola	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix serissima	--	--	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--
Salix sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Viburnum trilobum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	00	00	00	00	00	00	00	00	00	00	30	00	60	00	00	00	00	00	85

LAYER NUMBER 4: SHRUB CANOPY II 31 SPECIES

VEGETATION PLOT NUMBER	AF83 041	AF83 042	AF83 043	AF83 044	AF83 045	AF83 046	AF83 047	AF83 048	AF83 049	AF83 050	AF83 051	AF83 052	AF83 053	AF83 054	AF83 055	AF83 056	AF83 057	AF83 058	AF83 059
Actaea rubra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Amelanchier alnifolia	--	--	--	--	--	02	03	--	--	--	--	--	--	--	--	--	--	--	--
Betula papyrifera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Betula pumila	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cornus stolonifera	--	--	--	--	--	--	--	--	--	--	--	--	25	20	05	60	02	50	--
Corylus cornuta	--	--	--	--	--	--	07	--	--	--	--	--	--	--	--	--	--	--	17
Elaeagnus commutata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lonicera dioica	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--
Lonicera sp.	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--	--	--
Populus balsamifera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Populus tremuloides	25	--	--	--	--	03	--	05	--	--	--	--	--	--	--	--	--	--	--
Prunus pensylvanica	--	--	--	--	--	--	15	--	--	--	--	--	--	--	--	--	--	--	--
Prunus virginiana	--	--	--	--	--	10	--	03	--	--	--	--	--	--	--	--	--	--	--
Ribes americanum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ribes oxyacanthoides	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rosa acicularis	--	--	--	--	--	15	15	--	--	--	--	--	--	--	--	--	--	--	01
Rosa woodsii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rubus strigosus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01
Salix bebbiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix candida	--	--	--	--	01	--	--	--	--	--	--	--	05	--	--	10	--	15	--
Salix pedicellaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix petiolaris	--	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix planifolia	--	--	--	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--
Salix pseudomonticola	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix serissima	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salix sp.	--	--	--	--	04	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Shepherdia canadensis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Spiraea alba	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--	--	--	--
Symphoricarpos albus	--	--	--	--	--	15	--	--	--	--	--	--	--	--	--	--	--	--	--
Symphoricarpos occidentalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03
Viburnum edule	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL	25	00	02	00	05	40	30	10	00	00	00	00	35	20	05	70	02	60	20

LAYER NUMBER 5: HERB-DWARF SHRUB 288 SPECIES

VEGETATION PLOT NUMBER	AF83 041	AF83 042	AF83 043	AF83 044	AF83 045	AF83 046	AF83 047	AF83 048	AF83 049	AF83 050	AF83 051	AF83 052	AF83 053	AF83 054	AF83 055	AF83 056	AF83 057	AF83 058	AF83 059
Achillea millefolium	--	.5	--	--	--	.5	--	01	02	03	.5	--	--	--	--	--	--	--	--
Actaea rubra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01
Agoseris glauca	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron dasystachyum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron repens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron smithii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron sp.	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agropyron subsecundum	--	03	--	--	--	03	--	03	03	05	--	--	--	--	--	--	--	--	--
agropyron trachycaulum	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agrostis scabra	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--
Alopecurus aequalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Androsace septentrionalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anemone canadensis	--	--	--	--	--	--	--	--	.1	.5	--	--	--	--	--	--	--	--	--
Anemone patens	--	--	--	--	--	--	--	--	.5	.5	--	--	--	--	--	--	--	--	--
Anemone sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Antennaria nitida	--	10	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--
Antennaria pulcherrima	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Antennaria rosea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arabis holboellii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aralia nudicaulis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arctostaphylos uva-ursi	--	--	--	--	--	01	--	01	05	--	--	--	--	--	--	--	--	--	--
Arenaria lateriflora	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--
Artemisia campestris	.5	--	--	--	--	--	--	--	01	--	--	.5	--	--	--	--	--	--	--
Artemisia frigida	--	03	--	--	--	--	--	--	05	05	--	03	--	--	--	--	--	--	--
Artemisia longifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Artemisia ludoviciana	--	--	--	--	--	--	--	--	05	07	--	03	--	--	--	--	--	--	--
Aster ciliolatus	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--
Aster junciformis	--	--	03	--	--	--	--	--	--	--	--	--	--	--	.1	.1	--	--	--
Aster laevis	--	--	--	--	--	01	01	.5	.5	--	--	--	--	--	--	--	--	--	--
Aster pansus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aster sp.	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--
Astragalus flexuosus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Astragalus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Astragalus striatus	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--
Beckmannia syzigachne	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Betula pumila	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	--	05	--	--
Bidens cernua	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bouteloua gracilis	--	--	--	--	--	--	--	--	03	03	--	05	--	--	--	--	--	--	--
Bromus anomalus	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--
Bromus ciliatus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromus inermis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calamagrostis canadensis	--	--	--	--	--	--	--	--	--	--	07	--	--	--	--	--	--	--	01
Calamagrostis inexpansa	--	02	20	02	10	--	--	--	--	--	.1	--	--	--	--	--	--	--	--
Calamagrostis sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calamovilfa longifolia	--	--	--	--	--	--	--	--	--	--	--	20	--	--	--	--	--	--	--
Campanula rotundifolia	--	--	--	--	--	01	01	01	02	01	--	01	--	--	--	--	--	--	--
Cardamine pensylvanica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex aquatilis	--	--	--	03	25	--	--	--	--	--	03	--	--	--	02	30	07	01	--
Carex aurea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex canescens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex capillaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex crawfordii	--	--	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--
Carex diandra		01											--	05	13	--	20	--	--

Carex disperma	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	03
Carex eleocharis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex foenea	05	--	--	--	--	--	--	30	--	--	--	--	--	--	--	--	--	--	--
Carex heliophila	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex interior	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15	--
Carex lasiocarpa	--	01	--	05	20	--	--	--	--	--	--	--	--	03	--	05	--	--	--
Carex limosa	--	--	--	--	--	--	--	--	--	--	--	--	--	03	05	--	05	--	--
Carex livida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex obtusata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex parryana	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex praegracilis	--	01	--	--	--	--	--	--	--	--	--	--	30	--	--	--	--	--	--
Carex prairea	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--	05	--	15	--
Carex rostrata	--	--	--	--	20	--	--	--	--	--	65	--	05	--	--	--	03	--	--
Carex sartwellii	--	--	--	--	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex sp.	--	--	15	--	--	08	10	--	20	10	--	05	--	--	--	--	--	--	--
Carex sprengelii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex vaginata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carex viridula	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Castilleja miniata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Castilleja sp.	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--
Cerastium arvense	--	03	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--
Chamaerhodos erecta	.5	--	--	--	--	--	--	--	.5	--	--	02	--	--	--	--	--	--	--
Chrysopsis villosa	.5	--	--	--	--	--	--	--	01	--	--	01	--	--	--	--	--	--	--
Cicuta douglasii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cirsium arvense	--	01	--	.5	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--
Cirsium flodmanii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cirsium vulgare	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Commandra pallida	--	--	--	--	--	--	--	--	05	01	--	--	--	--	--	--	--	--	--
Cornus canadensis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	07
Cornus stolonifera	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--
Corralorhiza trifida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Crepis runcinata	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Crepis sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Crepis tectorum	--	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	.1	--	--
Cryptantha fendleri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyperus schweinitzii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cypripedium calceolus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Danthonia intermedia	--	--	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--	--
Deschampsia caespitosa	--	03	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Descurainia sophia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Disporum trachycarpum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Distichlis stricta	--	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Draba nemorosa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drosera anglica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	--	--	--
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Eleocharis compressa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eleocharis palustris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Eriophorum chamissonis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eriophorum viridi-carinatum	--	--	--	--	--	--	--	--	--	--	--	--	--	02	02	--	02	--	--
Erysimum asperum	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--
Erysimum inconspicuum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Erysimum sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Festuca saximontana	07	--	--	--	--	.5	--	--	10	--	--	07	--	--	--	--	--	--	--
Festuca scabrella	--	--	--	--	--	--	--	--	03	10	--	--	--	--	--	--	--	--	--
Fragaria virginiana	--	--	--	--	--	05	01	02	--	--	.1	--	.5	--	--	--	--	--	--
Gaillardia aristata	--	--	--	--	--	--	--	--	01	01	--	--	--	--	--	--	--	--	--
Galium boreale	--	--	--	--	--	05	05	10	--	05	--	--	--	--	--	--	--	--	--
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Gaura coccinea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gentiana amarella	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--
Gentiana crinata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Geranium richardsonii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Glaux maritima	--	05	--	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Glyceria borealis	--	--	05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Glyceria striata	--	--	--	--	--	--	--	--	--	--	05	--	--	--	--	--	--	--	01
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Habenaria hyperborea	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	01	--	--	--	.1
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Hackelia americana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hackelia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Helictotrichon hookeri	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--	--
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Hordeum jubatum	--	05	02	10	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hudsonia tomentosa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Juncus alpinus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	--
Juncus balticus	--	05	05	05	03	--	--	--	--	--	--	.5	--	--	--	--	--	--	--
Juncus longistylis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Juncus tenuis	--	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--
Juniperus communis	04	--	--	--	--	.1	02	25	--	--	--	--	--	--	--	--	--	--	--
Juniperus horizontalis	10	--	--	--	--	03	01	--	35	--	--	--	--	--	--	--	--	--	--
Koeleria cristata	01	--	--	--	--	--	--	--	02	10	--	--	--	--	--	--	--	--	--
Lappula redowski	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lathyrus ochroleucus	--	--	--	--	--	--	02	05	--	--	--	--	--	--	--	--	--	--	--
Lepidium ramosissimum	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lilium philadelphicum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Linnaea borealis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03
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Lysimachia ciliata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Maianthemum canadense	--	--	--	--	--	01	02	--	--	--	--	--	--	--	--	--	--	--	--
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Orthocarpus luteus	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--
Oryzopsis asperifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Polygonum amphibium	--	--	02	--	01	--	--	--	--	--	03	--	--	--	--	--	--	--	--
Populus tremuloides	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Psoralea agrophylla	--	--	--	--	--	--	--	--	--	.5	--	--	--	--	--	--	--	--	--
Puccinellia nuttalliana	--	02	--	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrola asarifolia	--	--	--	--	--	--	01	--	--	--	--	--	.5	--	--	--	--	--	01
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Ranunculus cymbalaria	--	01	--	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ranunculus gmelinii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Symphoricarpos albus	--	--	--	--	--	--	15	--	--	--	--	--	--	--	--	--	--	--	--
Symphoricarpos occidentalis	--	01	--	--	--	--	--	--	--	20	--	--	--	--	--	--	--	--	--
Taraxacum officinale	--	01	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1
Thalictrum venulosum	--	--	--	--	--	05	05	--	--	--	--	--	--	--	--	--	--	--	--
Thermopsis rhombifolia	--	--	--	--	--	--	--	10	05	02	--	--	--	--	--	--	--	--	--
Tofieldia glutinosa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--
Tragopogon dubius	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--	--	--
Triglochin maritima	--	--	--	--	--	--	--	--	--	--	--	--	--	01	03	--	07	01	--
Triglochin palustris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Typha latifolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.5	--	--
Urtica gracilis	--	--	--	.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Utricularia intermedia	--	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--
Vicia americana	--	--	--	--	--	05	01	--	--	--	--	--	--	--	--	--	--	--	--
Vicia sparsifolia	--	--	--	--	--	--	--	--	--	02	--	--	--	--	--	--	--	--	--
Viola adunca	--	.1	--	--	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--
Viola nephrophila	--	--	03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Viola rugulosa	--	--	--	--	--	--	03	--	--	--	--	--	--	--	--	--	--	--	01
Zizia aptera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zygadenus elegans	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.1
TOTAL	25	70	95	60	95	40	40	60	70	80	75	45	30	40	60	50	70	40	25

LAYER NUMBER 6: BRYOID 56 SPECIES

VEGETATION PLOT NUMBER	AF83 041	AF83 042	AF83 043	AF83 044	AF83 045	AF83 046	AF83 047	AF83 048	AF83 049	AF83 050	AF83 051	AF83 052	AF83 053	AF83 054	AF83 055	AF83 056	AF83 057	AF83 058	AF83 059
Amblystegium serpens	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Amblystegium varium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aulacomnium palustre	--	--	--	--	--	--	--	--	--	--	--	--	25	--	--	--	--	--	--
Brachythecium ellipticum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachythecium salebrosum	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachythecium sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01
Brachythecium turgidum	--	--	--	--	--	--	--	--	--	--	--	--	--	05	16	--	--	--	--
Bryum pseudotriquetrum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--	--	02
Calliergon giganteum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01
Campylium hispidulum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	02
Campylium stellatum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ceratodon purpurea	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--	--
Cetraria ericetorum	02	--	--	--	--	--	--	--	.1	--	--	03	--	--	--	--	--	--	--
Cetraria nivalis	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia chlorophaea	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia coccifera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia coniocraea	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia incinatus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladonia mitis	20	--	--	--	--	.1	--	--	05	--	--	.1	--	--	--	--	--	--	--
Cladonia pyxidata	01	--	--	--	--	--	--	--	02	--	--	03	--	--	--	--	--	--	--
Cladonia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cornicularia aculeata	02	--	--	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--	--
Dicranum fuscescens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dicranum muehlenbeckii	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--
Dicranum sp.	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drepanocladus aduncus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drepanocladus exannulatus	--	--	--	--	--	--	--	--	--	--	--	--	03	--	--	--	--	--	--
Drepanocladus revolvens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	--	--	--	01
Drepanocladus sp.	--	--	04	--	--	--	--	--	--	--	--	--	--	75	--	05	60	02	--
Evernia mesomorpha	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Helodium blandowii	--	--	--	--	--	--	--	.1	--	--	--	--	--	--	--	--	--	--	--
Hypnum cupressiforme	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Leptobryum pyriforme	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lichen spp	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Meesia triquetra	--	--	--	--	--	--	--	--	--	--	--	--	--	--	03	--	03	03	--
Mosses	--	--	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parmelia chlorochra	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--	--
Parmelia septentrionalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parmelia sulcata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parmeliopsis hyperopta	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Peltigera rufescens	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Physcia aipolia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Physcia orbicularis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Physcia stellaris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Physia adscendens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Plagiomnium ellipticum	--	--	--	--	--	--	--	--	--	--	--	--	.1	--	--	--	--	--	13
Pohlia nutans	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polytrichum juniperinum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polytrichum piliferum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polytrichum sp.	--	--	--	--	--	--	--	--	--	--	--	--	01	--	--	--	--	--	--
Pylaisiella polyantha	--	--	--	--	--	.1	.1	.1	--	--	--	--	--	--	--	--	--	--	--
Splachnum ampullaceum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thuidium recognitum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

```
   Tomenthypnum nitens        --    --    --    --    --    --    --    --    --    --    --    --    47    --    --    55    --    45    --
   Tortula ruralis            --    --    --    --    --    .1    --    --    --    --    --    --    --    --    --    --    --    --    --
   Xanthoria fallax           --    --    --    --    --    --    --    --    --    --    --    --    --    --    --    --    --    --    --
   TOTAL                      30    00    05    00    00    .5    .2    .3    07    00    00    10    75    80    70    60    60    50    20
T=0.169 DR=2    $.16,   $4.69T


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APPENDIX 8

ANNOTATED SPECIES LIST OF BIRDS

This list was compiled from field observations made during May, June and July, 1983, and from Bradley and Bradley (1977). Birds seen only by Bradley and Bradley are indicated by *.

Loons [Order Gaviiformes]

Common Loon (*Gavia immer*): Rare. One seen July 15, 1983 on Wallaby Lake.

Grebes [Order Podicipediformes]

Red-necked Grebe (*Podiceps grisegena*): Uncommon. Seen occasionally on beaver ponds and on Wallaby Lake.

Horned Grebe (*Podiceps auritus*): Uncommon. Seen on both lakes and most beaver ponds.

Eared Grebe (*Podiceps nigricollis*): Fairly common. A colony of about 50 birds nested on David Lake.

Pied-billed Grebe (*Podilymbus podiceps*): Uncommon. Heard in some small marshes.

Herons [Order Ciconiiformes]

*Great Blue Heron (*Ardea herodias*): One seen flying over area. Probably forages in study area.

*American Bittern (*Botaurus lentiginosus*): Heard calling in Ribstone marshes and probably forages in study area.

Waterfowl [Order Anseriformes]

Canada Goose (*Branta canadensis*): Fairly common. Two pairs and 11 young seen on David Lake.

Mallard (*Anas platyrhynchos*): Common. Observed on most sloughs, beaver ponds and both lakes.

Gadwall (*Anas strepera*): Fairly common. Observed on both lakes.

Northern Pintail (*Anas acuta*): Uncommon. Seen on David Lake and beaver ponds.

Green-winged Teal (*Anas crecca*): Fairly common. Observed on most sloughs and beaver ponds, and on both lakes.

Blue-winged Teal (*Anas discors*): Common. Seen on sloughs, beaver ponds and both lakes.

American Wigeon (*Anas americana*): Fairly common. Seen on most sloughs, beaver ponds and both lakes.

Northern Shoveler (*Anas clypeata*): Uncommon. Seen on both lakes.

Redhead (*Aythya americana*): Uncommon. Seen on both lakes.

Canvasback (*Aythya valisineria*): Uncommon. Seen on both lakes and a beaver pond.

Lesser Scaup (*Aythya affinis*): Fairly common. Seen on both lakes and beaver ponds.

Bufflehead (*Bucephala albeola*): Fairly common. Seen on both lakes and the large beaver pond.

White-winged Scoter (*Melanitta fusca*): Uncommon. A flock of about 100 birds seen on Wallaby Lake May 25, 1983.

Ruddy Duck (*Oxyura jamaicensis*): Uncommon. Seen on both lakes.

Hawks [Order Falconiformes]

Northern Goshawk (*Accipiter gentilis*): One seen in poplar near beaver ponds.

Sharp-shinned Hawk (*Accipiter striatus*): Occasional. A few individuals seen flying between aspen groves.

Cooper's Hawk (*Accipiter cooperii*): Occasional. A few seen flying between aspen groves.

Red-tailed Hawk (*Buteo jamaicensis*): Fairly common. Several pairs seen foraging in study area. One active nest found.

Broad-winged Hawk (*Buteo platypterus*): Uncommon. A few individuals seen flying between aspen groves near both lakes and in aspen scrub.

Swainson's Hawk (*Buteo swainsoni*): Uncommon. Occasionally seen foraging near study area.

*Merlin (*Falco columbarius*): Two active nests found in dune aspen groves.

*American Kestrel (*Falco sporverius*): One heard in study area.

Grouse and their allies [Order Galliformes]

Ruffed Grouse (*Bonasa umbellus*): Fairly common. Seen singly or with chicks in aspen groves. Commonly heard drumming.

Sharp-tailed Grouse (*Tympanuchus phasianellus*): Uncommon. No birds seen, but droppings often found.

Cranes and their allies [Order Gruiformes]

Sandhill Crane (*Grus canadensis*): Uncommon. A pair seen July 14 and 18, 1983 foraging in bulrush around David Lake. A pair with two young reported foraging in a grain field south of David Lake May 1983.

Sora (*Porzana carolina*): Uncommon. Heard calling from marshes.

*Yellow Rails (*Coturnicops noveboracensis*): Found along Ribstone Creek.

American Coot (*Fulica americana*): Fairly common. Found on both lakes.

Shorebirds and Gulls [Order Charadriformes]

Killdeer (*Charadrius vociferus*): Fairly common. Seen around both lakes.

Black-bellied Plover (*Pluvialis squatarola*): Occasional. Flock of 25 seen near David Lake May 1983.

Common Snipe (*Gallinago gallinago*): Fairly common. Seen on fens and marshes in lakes and beaver ponds.

Upland Sandpiper (*Bartramia longicauda*): Occasional. One seen on fence post in grassland.

Spotted Sandpiper (*Actitis macularia*): Fairly common. Seen on shores of both lakes.

Lesser Yellowlegs (*Tringa flavipes*): Uncommon. Seen on mudflats around David Lake.

Willet (*Catoptrophorus semipalmatus*): Uncommon. Seen around both lakes and flying over study area.

Short-billed Dowitcher (*Limnodromus griseus*): Occasional. Flock seen on David Lake May 1983.

Marbled Godwit (*Limosa fedoa*): Uncommon. A few seen on David Lake and in aspen scrub.

American Avocet (Recurvirostra americana): Uncommon. Seen on David Lake.

Wilson's Phalarope (Phalaropus tricolor): Fairly common. A flock of five to 15 resided on David Lake.

California Gull (Larus californicus): Uncommon. Seen foraging on David Lake.

Ring-billed Gull (Larus delawarensis): Fairly common. Seen on David Lake.

Franklin's Gull (Larus pipixcan): Fairly common. Seen around lakes and sloughs.

*Bonaparte's Gull (Larus philadelphia): Occasional. Two adults seen on small sloughs east of Ribstone Creek.

Black Tern (Chlidonias niger): Uncommon. Seen foraging near Wallaby Lake.

Pigeons and Doves [Order Columbiformes]

Mourning Dove (Zenaida macroura): Fairly common. Seen and heard in aspen groveland.

Cuckoos [Order Cuculiformes]

*Black-billed Cuckoo (Coccyzus erythropthalmus): Several heard calling from edge of Ribstone Creek.

Owls [Order Strigiformes]

Great Horned Owl (Bubo virginiana): Uncommon. One seen in aspen forest in study area and two seen in aspen groves close to study area.

*Long-eared Owl (Asio otus): Seen along Ribstone Creek.

*Northern Saw-whet Owl (Aegolius acadicus): Heard and seen along Ribstone Creek.

Nighthawks [Order Caprimulgiformes]

Common Nighthawk (Chordeiles minor): Common. Often seen or heard overhead, especially in dune region.

Hummingbird [Order Apodiformes]

Ruby-throated Hummingbird (*Archilochus colubris*): Uncommon. One seen on edge of study area.

Woodpeckers [Order Piciformes]

Northern Flicker (*Colaptes auratus*): Fairly common. Seen throughout study area.

Yellow-bellied Sapsucker (*Sphyrapicus varius*): Uncommon. Two seen in aspen groves.

Hairy Woodpecker (*Picoides villosus*): Uncommon. Seen in aspen groves throughout study area.

Downy Woodpecker (*Picoides pubescens*): Uncommon. Found in aspen groves throughout study area.

Perching Birds [Order Passeriformes]

Eastern Kingbird (*Tyrannus tyrannus*): Fairly common. Often seen foraging in grasslands and by beaver ponds.

Western Kingbird (*Tyrannus verticalis*): Uncommon. Two seen on edge of study area in grassland.

Say's Phoebe (*Sayornis saya*): Uncommon. Several seen foraging in grasslands in May and early June.

Alder Flycatcher (*Empidonax alnorum*): Fairly common. Seen in low spots in dense willows.

Least Flycatcher (*Empidonax minimus*): Fairly common. Seen in low areas in dense shrubs.

Horned Lark (*Eremophila alpestris*): Uncommon. Seen only in cultivated fields.

Tree Swallow (*Tachycineta bicolor*): Fairly common. Seen throughout study area.

Barn Swallow (*Hirundo rustica*): Fairly common. Seen throughout study area.

Blue Jay (*Cyanocitta cristata*): Fairly common. Often seen and heard in aspen groves.

Black-billed Magpie (*Pica pica*): Fairly common. Seen throughout study area.

American Crow (*Corvus brachyrhynchos*): Common. Seen throughout study area.

Black-capped Chickadee (*Parus atricapillus*): Common. Seen in aspen groves.

*Red-breasted Nuthatch (*Sitta canadensis*): Seen once in study area.

House Wren (*Troglodytes aedon*): Uncommon. Seen in aspen poplar forest.

Marsh Wren (*Cistothorus palustris*): Fairly common. Seen and heard in fens and marshes.

*Gray Catbird (*Dumetella carolinensis*): Occasional. In shrubbery.

*Brown Thrasher (*Toxostoma rufum*): Occasional. One heard singing by Ribstone Creek.

American Robin (*Turdus migratorius*): Common. Seen foraging and heard singing throughout study area.

Hermit Thrush (*Catharus guttatus*): Fairly common. Heard singing and seen foraging in dense aspen and balsam poplar forest.

Veery (*Catharus fuscescens*): Uncommon. Found in aspen forest.

Mountain Bluebird (*Sialia currucoides*): Fairly common. Seen foraging and singing in grassland/woodland ecotone.

*Water Pipit (*Anthus spinoletta*): Occasional. Seen migrating in the fall.

Sprague's Pipit (*Anthus spragueii*): Uncommon. Heard and seen in areas of undisturbed grassland.

Cedar Waxwing (*Bombycilla cedrorum*): Fairly common. Individual birds and nests observed in aspen and willow groves.

Red-eyed Vireo (*Vireo olivaceus*): Uncommon. Inhabits aspen groves.

*Warbling Vireo (*Vireo gilvus*): Uncommon. Found in poplar woods.

Black-and-white Warbler (*Mniotilta varia*): Uncommon. Heard singing in dense willow and poplar stands.

*Tennessee Warbler (*Vermivora peregrina*): Fairly common. Found in willows at marsh edges.

*Orange-crowned Warbler (*Vermivora celata*): Occasional. Found in dense shrubs and woodlands around marshes.

Yellow Warbler (Dendroica petechia): Uncommon. Found throughout study area in shrubbery.

*Yellow-rumped Warbler (Dendroica coronata): Occasional. One heard singing at Wallaby Lake. Common migrant.

Ovenbird (Seiurus aurocapillus): Fairly common. Heard singing in poplar forest.

Common Yellowthroat (Geothlypis trichas): Fairly common. In bulrush and cattail marshes and in fens.

American Redstart (Setophaga ruticilla): Uncommon. Seen in poplar woods.

Western Meadowlark (Sturnella neglecta): Uncommon. Heard singing in grassland next to David Lake.

Yellow-headed Blackbird (Xanthocephalus xanthocephalus): Fairly common. Colonies in bulrush stands around David Lake.

Red-winged Blackbird (Agelaius phoeniceus): Common. In marshes on both lakes and on beaver ponds.

Northern Oriole (Icterus galbula): Fairly common. Often heard singing or seen in aspen forest.

*Rusty Blackbird (Euphagus carolinus): Seen migrating in fall.

Brewer's Blackbird (Euphagus cyanocephalus): Uncommon. Seen in shrubs near David Lake.

Brown-headed Cowbird (Molothrus ater): Uncommon. Seen throughout study area.

*Rose-breasted Grosbeak (Pheucticus ludovicianus): Rare. A breeding pair seen in poplars.

*Lazuli Bunting (Passerina amoena): Rare. One heard singing by Ribstone Creek.

*Pine Siskin (Carduelis pinus): Uncommon. Seen migrating in fall.

American Goldfinch (Carduelis tristis): Fairly common in dense shrubs.

*Red Crossbill (Loxia curvirostra): Occasional. Seen feeding in poplars.

Savannah Sparrow (Passerculus sandwichensis): Common. In grasslands, usually near shrubs.

*Baird's Sparrow (Ammodramus bairdii): Occasional. Heard singing in hay fields by Ribstone Creek near study area.

Le Conte's Sparrow (*Ammodramus leconteii*): Fairly common. In sedge meadows and fens.

Sharp-tailed Sparrow (*Ammodramus caudacutus*): Uncommon. Heard and seen in fens.

Vesper Sparrow (*Pooecetes gramineus*): Common. Inhabits grasslands where shrubs are nearby for escape cover.

Lark Sparrow (*Chondestes grammacus*): Occasional. A few individuals seen in grasslands near aspen forest.

Dark-eyed Junco (*Junco hyemalis*): Common. In shrubs and woodlands.

*Tree Sparrow (*Spizella arborea*): Seen during fall migration.

Chipping Sparrow (*Spizzella passerina*): Fairly common. Seen in poplar groves.

Clay-coloured Sparrow (*Spizzella pallida*): Common. In the grassland-shrub ecotone.

*Harris' Sparrow (*Zonotrichia querula*): Seen during fall migration.

White-throated Sparrow (*Zonotrichia albicollis*): Fairly common. Often heard singing in poplar forests.

*Lincoln's Sparrow (*Melospiza lincolnii*): Uncommon. Found in the shrub-wet meadow interface.

Song Sparrow (*Melospiza melodia*): Uncommon. Seen in woodland groves.

APPENDIX 9

ANNOTATED LIST OF MAMMALS - OBSERVED AND EXPECTED

The information for this list was obtained from field observations during May, June and July, 1983, and from a report on the mammalian fauna in the area by Salt (1977) and from Banfield (1974). An asterisk (*) indicates the species recorded only by Salt.

* Masked Shrew (*Sorex cinereus*): Collected in region and expected in study area.

* Vagrant Shrew (*Sorex vagrans*): Collected in region and expected in study area.

* American Water Shrew (*Sorex palustris*): Collected on Ribstone Creek marshes. One shrew observed near beaver pond believed to be of this species based on appearance and behavior.

* Arctic Shrew (*Sorex arcticus*): Collected in region just east of study area. Constitutes a range extension to the southeast.

Pygmy Shrew (*Microsorex hoyi*): Expected in study area.

Little Brown Bat (*Myotis lucifugus*): No collection of this or any other species of bat have been made in region. Expected in study area.

Long-eared Bat (*Myotis evotis*): May occasionally occur in study area.

Long-legged Bat (*Myotis volans*): Expected in study area.

Small-footed Bat (*Myotis leibii*): May occasionally occur in study area.

Silver-haired Bat (*Lasionycteris noctivagans*): May occasionally occur in study area.

Big Brown Bat (*Eptesicus fuscus*): Expected in study area.

Hoary Bat (*Lasiurus cinereus*): Expected in study area.

* Nuttall's Cottontail (*Sylvilagus nuttallii*): Skull fragments found in raptor pellets believed to be of this species. A northern range extension if species presence confirmed.

* Snowshoe Hare (*Lepus americana*): Seen by Salt in region but none observed by author. Expected to occur in study area.

White-tailed Jack Rabbit (*Lepus townsendii*): Two individuals observed in southeast corner of study area. Seen in region by Salt but probably never common in area because of rough topography.

Least Chipmunk (*Eutamias minimus*): Uncommon. Seen in aspen and balsam poplar stands.

* Woodchuck (*Marmota monax*): Seen by Salt in early 1960s. May occasionally occur in study area.

Richardson's Ground Squirrel (*Spermophilus richardsonii*): Seen only on southeast edge of study area. Suitable habitat present but species not seen in study area.

Thirteen-lined Ground Squirrel (*Spermophilus tridecemlineatus*): Fairly common. Observations of individuals made throughout study area in grassland close to aspen or buckbrush cover.

Franklin's Ground Squirrel (*Spermophilus franklinii*): Expected in aspen groves in study area.

American Red Squirrel (*Tamiasciurus hudsonicus*): Fairly common in aspen and balsam poplar stands.

Northern Pocket Gopher (*Thomomys talpoides*): None observed but tunnel mounds seen frequently throughout study area.

American Beaver (*Castor canadensis*): Fairly common. Five beaver pond complexes present in area north and west of David Lake. At least six active beaver lodges found. Beaver ponds are associated with fens and usually found where shoreline vegetation is predominantly aspen and balsam poplar and willows.

* Deer Mouse (*Peromyscus maniculatus*): None observed but expected. Collected by Salt in region.

* Gapper's Red-backed Vole (*Clethrionomys gapperi*): Collected in region and expected in study area.

Northern Bog Lemming (*Synaptomys borealis*): May occur in study area.

Heather Vole (*Phenacomys intermedius*): May occur in study area.

Muskrat (*Ondatra zibethicus*): Seen in region but no individuals seen in study area despite suitable habitat in David Lake.

* Prairie Vole (*Microtus orchrogaster*): Collected in region and may be present in study area.

Meadow Vole (*Microtus pennsylvanicus*): Fairly common. Seen and collected in area.

Western Jumping Mouse (Zapus princeps): Present in region and probably occurs in study area.

* Meadow Jumping Mouse (Zapus hudsonius): Seen in region.

American Porcupine (Erethizon dorsatum): Seen in region and expected in study area.

Coyote (Canis latrans): Seven coyote observations made, including two pups seen by a den. Number of dens found indicates a large population in area.

Red Fox (Vulpes vulpes): One observed 4 km south of study area. Expected in study area.

* Ermine (or Short-tailed Weasel) (Mustela erminea): Signs of this species' presence in region noted by Salt.

* Long-tailed Weasel (Mustela frenata): Collected in region and expected in study area.

* Least Weasel (Mustela nivalis): Collected in region and expected in study area.

* Mink (Mustela vison): May occasionally occur in extreme southwest corner of study area in Ribstone Creek Valley and in David Lake and beaver pond complexes.

American Badger (Taxidea taxus): Uncommon. One badger seen by its den in central portion of dunes. Other dens believed made by species found sporadically throughout dune region. According to ranchers in region badgers seen fairly regularly.

* Striped Skunk (Mephitis mephitis): Expected in study area.

Lynx (Lynx lynx): May occur in study area.

Mule Deer (Odocoileus hemionus): Fairly common. Five sightings of species made (out of 30 total identified deer sightings).

White-tailed Deer (Odocoileus virginianus): Common. Twenty-five sightings of species made, including six fawn observations (two sets of twins and two individuals observed).

Moose (Alces alces): Droppings and tracks seen often in area. Either a small resident population or transients.

APPENDIX 10

ANNOTATED LIST OF AMPHIBIANS AND REPTILES

Tiger Salamander (*Ambystoma tigrinum*): Uncommon. Three larval salamanders found in shallow water in Wallaby Lake. Probably more common than the number of observations indicate.

Canadian Toad (*Bufo americanus hemiophrys*): Fairly common. Moist woods, fens and on shorelines. Spawning areas found in shallow pools in fens and willow swamps.

Wood Frog (*Rana sylvatica*): Fairly common. Moist woods and grasslands.

Boreal Chorus Frogs (*Pseudacris triseriata maculata*): Fairly common. Standing water.

Plains Garter Snake (*Thamnophis radix*): Uncommon. Found in areas of lush vegetation. Two were observed in moist grassland on north shore of David Lake.